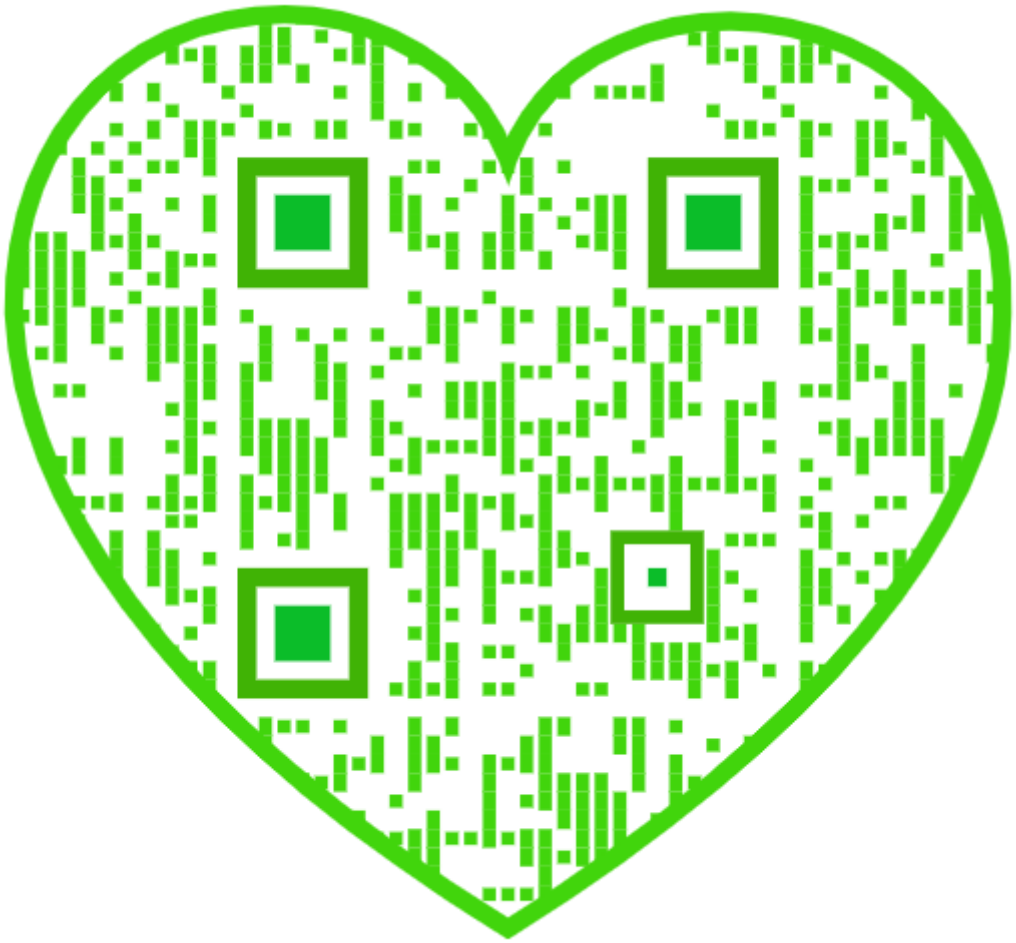

LIPPINCOTT'S UNIT TEXTS

EDITED BY BENJAMIN R. ANDREWS, PH.D.

ASSISTANT PROFESSOR OF HOUSEHOLD ECONOMICS, TEACHERS COLLEGE, COLUMBIA UNIVERSITY

HOUSEHOLD ARITHMETIC

BY

KATHARINE F. BALL, M.A.

UNIVERSITY OF MINNESOTA

AND

MIRIAM E. WEST, M.A.

GIRLS VOCATIONAL HIGH SCHOOL, MINNEAPOLIS

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39 ILLUSTRATIONS

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UNIV. OF CALIFORNIA

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PREFACE

THERE is a widespread conviction that girls need more training in the kind of mathematics used in everyday life than is afforded in the traditional courses. The complaint is made that girls fail to reason correctly when confronted by practical problems; that they lack skill and foresight in transactions involving expenditures of money; that they do not understand how to make approximations, how to interpret graphs—in a word, that their "mathematics does not function."

To remedy this condition involves not necessarily more training but different training, as well as a reorganization of the mathematics courses to meet the needs of the students. Since one of the most important needs of girls is an intelligent understanding of home problems, the authors have used the subject matter of home economics for their contribution to the reorganization of arithmetic courses. The same methods might well be applied to subject matter chosen from other realms of experience, and the authors hope to extend their work into other fields to meet other needs.

The purposes of the book may be stated as follows:

a. To enable girls to understand and to interpret the economic problems in their own homes.

b. To develop skill in the computations and the methods of reasoning involved in everyday affairs so that arithmetic may become a tool in effective living.

c. To make girls readily see controlling number relations in practical situations.

The family budget forms the basis for the organization of the subject matter, thus emphasizing the economic aspect of homemaking. The material falls naturally into six sections. The first section is devoted to a study of the principles of budget-making and methods of keeping simple accounts. This is followed by a study of each of the five commonly accepted family budget divisions, *viz.*:

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food, shelter, clothing, operation, and higher life. These sections are independent of each other, and may be studied in any order that commends itself to the teacher who wishes to adapt the course to the special interests of any given group of girls or to correlate the work with other courses in the curriculum.

The problems included in each section have been selected in accordance with the following criteria:

a. The subject matter of the problems should be within the actual or potential experience of girls.

b. The problems should be of relatively frequent occurrence in everyday life, of relatively permanent significance, and of relatively wide or general applicability.

c. The arithmetical solution should also be the practical solution.

d. The technicalities or complexities of the subject matter should not be so great or so difficult as to obscure the arithmetical principles involved.

The book is intended for use in the regular arithmetic classes in the upper grades, in junior and senior high schools, in night schools, and technical classes, and in connection with courses in sewing, cooking, and home management such as are found in technical schools and in vocational schools organized under the Smith-Hughes Law, in which emphasis is placed upon the use of arithmetic in practical situations.

It has been assumed that the girls who will use the book have had preliminary training in the fundamental processes of arithmetic equivalent to that given in the first six or seven years of school. Previous school training in home economics, while desirable, is not an essential for students who have had some experience in their own homes in sewing, cooking, and marketing.

The major part of the book has been tested by class use in the eighth and ninth grades of the Girls' Vocational High School of Minneapolis and in the High School of Plainfield, N. J. The results of five years of experience seem to indicate that this method of organizing and presenting the subject matter has the following advantages:

a. It capitalizes the experience of girls and furnishes a reasonable motive for the study of arithmetic.

b. It develops skill and accuracy in the fundamental operations of arithmetic through repetition of these processes in their application to the various phases of home life.

c. It develops skill in the application of arithmetic to the problems of cooking, sewing and home management.

Generous assistance has come to the authors from so many sources that lack of space forbids specific mention of a large number. But grateful acknowledgment must be made especially to Dr. Henry M. Maxson, Superintendent of Schools of Plainfield, N. J., and Mr. Lindsey Best, Principal, for the opportunity to develop the course in the Plainfield High School; the late Professor Helen Kinne of Teachers College for her unfailing faith in the experiment; Professor David Snedden, Professor Frederick G. Bonser, and Professor William H. Kilpatrick of Teachers College for invaluable criticisms and suggestions; Professor Cleo Murtland of the University of Michigan, and Miss Laura I. Baldt of Teachers College, for reading the manuscript of the section on clothing; Professor Mary Swartz Rose of Teachers College for reading the section on foods; Professor Alice Biester and Miss Ethel L. Phelps of the University of Minnesota, not only for reading the entire manuscript, but also for arranging all the materials for the photographs.

THE AUTHORS.

JANUARY, 1920.

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BUDGETS AND ACCOUNTS

UNIV. OF CALIFORNIA

HOUSEHOLD ARITHMETIC

BUDGETS AND ACCOUNTS

The Family Budget

The family budget is a statement of the probable income and of the proposed expenditures for a definite period of time. The amounts may be estimated by the week, or month, or year. The budget is made by determining beforehand the probable income, the probable needs of the family, and the way in which the income is to be divided to meet those needs. The budget has been called the family compass. Only by following as closely as possible the course laid down in the budget, can the family be reasonably certain of attaining its desired goal.

Annual Income

Successful budget-making must be based upon an accurate estimate of the family income. If a man is employed by the year his income is more or less fixed; if he depends upon the day's wages his income will depend upon whether or not he is continuously employed; if he is a farmer his income depends upon success with his crops; if he is a doctor or lawyer his income varies from month to month according to the number of his patients or clients.

EXERCISE I

1. Mary Brown worked for 4 months in a millinery shop at $13 a week. She was laid off during the slack season, and after 7 weeks secured work as a salesgirl at $12 a week. Illness kept her away for 3 weeks. She spent 2 more weeks seeking work and finally secured a position in a millinery shop at $12.50 a week where she remained until the end of the year. What was her income for the year? Her average weekly wage?

2. In trades where there is a slack season the hands may be

laid off when the work is light. A man works 9 months and is laid off for 3 months during the winter. If he receives $4.50 per day while at work, what is his annual income? His average daily wage? (Estimate 26 days to the month.)

3. Which is the better job for a girl to take, one that pays $18 a week, with two slack seasons of 6 weeks each when she will probably be laid off, or a steady job that pays $14 a week? If she takes the first, how much should she set aside each week to provide for the periods of unemployment?

4. A public school teacher receives $85 a month for 10 months. What is her annual income? Her average monthly income?

5. What is the total annual income of a lawyer who clears $2375 in his practice and who receives interest from $4000 invested in bonds at 5 per cent.? What is his average monthly income?

6. Mrs. Lewis found upon going over the accounts that the profits from the farm for the past five years had been as follows: $2100, $1800, $1500, $1600, $2000. What was the average yearly income? What would you advise Mrs. Lewis to use as the basis for her budget? Why?

Budget Divisions

A budget, properly speaking, is an estimated division of the income into proposed expenditures for various purposes. The term is also used to signify the actual division of the expenditures for a year. The two kinds of budgets are sometimes distinguished by the terms "actual budget" and "theoretical budget."

Actual budgets are an aid in making theoretical budgets. The experience of others serves to show the possibilities and limitations of an income, but cannot be an infallible guide. In each family there are special needs to be met and special difficulties to be overcome.

In studying budgets, allowance must be made for the fact that most of the budget data available were compiled previous to the Great War, when prices were lower.

In budget making, the nature of the expenditures to be included in each division should be carefully determined, and the expenditures grouped under the proper heading. General directions regarding the items to be included in each group are as follows:

I. Food: All articles of food.

II. Shelter: Rent, taxes, insurance, repairs, interest on mortgage, car-fare to and from work.

III. Clothing: All articles of clothing, including underwear, dresses, suits, shoes, hats, etc.; materials for making such articles; cost of making and repairing them.

IV. Operation: Fuel for heat and light, household supplies, refurnishing, repairs, service (including laundry and expense of barber, etc.), telephone, express, and all other items connected with running the home plant.

V. Advancement or Higher Life: Church, benevolence, insurance, savings, travel, books, recreation, health, entertainment, education, postage, telegrams, the pleasures which make for social advancement, and other things not necessary to the maintenance of the merely physical efficiency of the family.

EXERCISE II

The per cent. of the income spent for each division of the budget is found by dividing the actual amount of money spent for items in that division by the total amount of the income.

Problem.—**Find the per cent. of the income spent on each division of the budget if the total income of $1200 was spent as follows: Food, $414; shelter, $240; clothing, $208; operation, $158; advancement, $180.**

Thus: $414 ÷ $1200 = .345, or 34.5 per cent., for food.
$240 ÷ $1200 = .20, or 20 per cent., for shelter.

1. The following are actual budgets of families in different parts of the United States. Find in each case the per cent. of the income spent for each of the five divisions of the budget, and tabulate the results. Include incidentals under advancement.

ACTUAL FAMILY BUDGETS[1]

	Income	Occupation	Food	Shelter	Clothing	Operation	Advancement	Incidentals
1.	$673	Business man.	$274	$105	$90	$62	$111	$31
2.	1007	Mechanic.....	361	168	134	66	237	41
3.	1400	Capitalist....	456	345	100	291	25	183
4.	1500	Geologist	220	270	160	260	550	40
5.	1800	High School Teacher....	216	360	225	209	740	50

[1]Adapted from Bruère, *Increasing Home Efficiency*. Used by permission of and special arrangement with the Macmillan Company, Publishers.

Group the following items of expenditure in the proper budget divisions (following the grouping on page 15); find the per cent. of the income spent on each division, and tabulate the results.[2]

2.	Income	$870.00
	Expenditures:	
	Rent	156.00
	Food at $8.50 a week	442.00
	Clothing	69.80
	Light and fuel	57.20
	Recreation	5.00
	Insurance	58.24
	Papers	5.72
	Car-fares	2.00
	Doctor and medicine	11.50
	Man, spending-money	18.20
	Stove $14, and housefurnishings $10	24.00
	Church	8.00
	Sundries (soap and washing materials, etc.)	12.34
3.	Income	1512.00
	Expenditures:	
	Rent, $28 a month	336.00
	Food for 5, $9 a week	468.00
	Clothing for 4	85.00
	Drink	52.00
	Light and fuel	49.00
	Recreation	25.00
	Insurance	26.00
	Papers and magazines	7.72
	Doctor and medicine	10.00
	Church	13.00
	Spending-money (man)	83.20
	Washerwoman, $1 a week	52.00
	Sundries	5.08
	Savings	300.00
4.	Farm: 150 acres. Income $1869.58. Family: Father, mother, Margaret. Two hired men and a maid in summer—none in winter.	
	Expenditures:	
	Groceries	$81.60
	Meat	10.09
	Medical aid	26.70
	Church	15.79
	Hired men	280.00
	Hired girl	41.52

[2] Data for examples 1 and 2 have been adapted from More's *Wage-Earners' Budgets*, Henry Holt and Company; for examples 3 and 4 from Bruère's *Increasing Home Efficiency*—used by permission of and special arrangement with the Macmillan Company, Publishers.

Clothes:	
Father	$36.60
Mother	67.40
Margaret (age 2 years)	26.95
Refurnishing	79.29
Amusements	19.80
Insurance:	
Fire	33.80
Life	95.00
Running expenses	123.50
Taxes	48.00
Magazines and papers	24.00
Books	22.00
Postage and express	19.80
Vacation trip	113.25
Club dues	20.00
Charity	25.00
Christmas gifts	45.00
Margaret's bank account	25.00
Improvements to place	16.80
Coal	120.00
Miscellaneous	49.98
Savings	402.71

5. Annual income, $1300. Family: a clerk, his wife, and an infant. Monthly expenditures as follows:

Rent	$25.00
Light	4.00
Heat	7.00
Water	.83
Groceries	9.00
Meat, eggs	8.00
Vegetables	5.00
Milk	6.50
Bread	2.50
Dessert	2.00
Laundry	6.00
Doctor, medicine	2.00
Clothes, shoes, etc.	5.00
Replacement of furniture	2.00
Building Loan	5.00
Health—Accident Insurance	2.50
Life Insurance	9.00
Lodge Insurance	.86
Magazines	.40
Newspapers	.48
Recreation	2.50
Church	1.00
Travel	1.00
Incidentals	1.00

EXERCISE III

In making budgets it is useful to know how much others in a similar occupation or with a similar income have spent on the different items of the budget.

Find the per cent. of the income spent for health by wage-earning women whose average incomes and expenditures are as follows[3]:

Occupation	Average income	Expenditures for health
1. Professional	$695	$26
2. Clerical	499	12
3. Sales	357	19
4. Factory	382	24
5. Waitress	364	11
6. Kitchen workers	342	8

7. From the above averages, how much should a salesgirl earning $7 per week allow for health for a year? How much per week?

Find the per cent. of the income invested in savings and insurance in each of the following individual cases[4]:

Occupation	Income	Expenditure for savings and insurance
8. Teacher	$1220	$465
9. Geologist	1500	256
10. Teacher	1700	300
11. Shop manager	2400	537

12. A teacher receives a salary of $130 per month for 10 months. How much should he set aside for savings and insurance during the year, if he saves at the same rate as the teacher in example 8?

13. Find how much rent your family is paying for your home, or, if the house is owned, what it would cost to rent a similar house in your community. What per cent. is this amount of the total family income?

---

[3] "The Living Wage of Women Workers." Women's Educational and Industrial Union. *Studies in Economic Relations of Women*, vol. iii, p. 78.

[4] Bruère, *Increasing Home Efficiency*. Used by permission of and arrangement with the Macmillan Company, Publishers.

Budget Making

Budgets prepared from the average expenditures of many families may be used as aids in planning how to live on a specified income. The following tables have been chosen as typical of the kind of budgets that are available for this purpose. They are intended to serve as suggestions, not as fixed standards. The record of past expenditures, if it is available, is the best guide in making a family budget.

The following suggested budgets by Mrs. Ellen H. Richards are based upon a study of family budgets and the cost of living for the typical American family of 2 adults and 3 children (equivalent to 4 adults).[5] While these budgets were made in 1900, they are still significant.

Table I.

Family income	Percentage for				
	Food	Rent	Operation	Clothes	Higher life
Two adults and two or three children (equal to four adults):					
Ideal division.....	25	20±	15±	15±	25
$2000 to $4000....	25	20±	15±	20±	20
$800 to $1000....	30	20	10	15	25
$500 to $800....	45	15	10	10	20
Under $500.....	60	15	5	10	10

The following table is based on the results of studies of family budgets made by Ellen H. Richards, Robert Coit Chapin, and Martha Bensley Bruère and Robert W. Bruère, modified to reflect the recent advance in the cost of living.

Table II.

The Division of the Family Income by Percentages for Families Averaging Two Adults and Two Children.

Yearly income	Food	Rent	Clothing	Operating expenses	Advancement
$1000 to $1500.....	35%	20%	13%	16%	16%
1500 to 2500.....	28%	20%	13%	19%	20%
2500 to 3500.....	24%	16%	14%	21%	25%
3500 to 5000.....	20%	15%	16%	18%	31%

[5] Richards' *Cost of Living*, p. 37.

EXERCISE IV

Find the amount to be allowed for each division of the budget, according to standards given in Richards' table, and tabulate the results for the following incomes:

1. Income, $489.
2. Income, $850.
3. Income, $625.
4. Income, $1250. (Use Richards' ideal division.)
5. Mr. H. worked 52 weeks at $14 a week, received $50 for extra work. A son 13 years old worked 46 weeks at $2 a week. Estimate the family budget.
6. A family own their own home which is valued at $2000, they raise vegetables to the amount of $120, and in addition to this, they have an income of $700. They pay $80 for taxes, insurance, and repairs. If property in this locality rents for 10 per cent. of its value, allowing for repairs, taxes, etc., how much gross income does the house theoretically add to the family income? How much net income? Estimate the family budget.
7. The Wentworths own a house valued at $12,000. Mr. Wentworth's income from other sources has been reduced from $6000 to $1200. Estimating that the property could be rented for 8 per cent. of its value, and allowing 3.5 per cent. for taxes, repairs, etc., how much, net, does the property add to his income? Make out a theoretical budget for the family. How would you suggest that the Wentworths modify their plan of living to conform to the standards?

Find the amount of money to be allowed for each division of the budget for the following incomes, using the percentages given in Table II, page 19:

8. $1275.
9. $4550.
10. $2100.
11. A teacher has a salary of $1200, his wife gives music lessons for four hours a week at $1 an hour. Make out a year's budget for the family.
12. Make out a budget for a family whose income is derived from the following sources: (*a*) House valued at $3000 (property in the vicinity rents for 10 per cent. of its value, including allowance of 4 per cent. for repairs, taxes, and other outgoes). (*b*) Man's salary, $1100. (*c*) Wife's income from magazine articles, $180.

EXERCISE V

In each of the following problems, state the authority on which you base your estimates:

1. A mechanic earning $25 a week wishes to rent a house in this community. He has a wife and 3 children. How much rent would you advise him to pay? What kind of house can he get for that amount? Select a house and, if possible, inspect it and report regarding condition, number of rooms, location, and improvements.

2. A salesman whose salary is $125 per month wishes to rent a house in or near this community. How much can he afford to pay? Can you recommend a house that would be suitable?

3. Investigate the kind of shelter that can be obtained in this community for a monthly rent of from $10 to $30. Tabulate the results with regard to condition, number of rooms, heat, light, water, sanitary conditions.

4. How much can a salesgirl whose weekly wages are $12 afford to pay for board and lodging? Where can she find board and lodging at that price in this community? Make a monthly budget for this girl.

5. Make out a budget for a stenographer whose wages are $15 a week. Include board and lodging.

6. Find how much is allowed per person per day in each of the budgets in Richards' table.

7. The Life Extension Institute in 1917 prepared adequate meals for 12 policemen for 3 weeks at a cost of 25 cents per person per day for food. If meals for a family of 4 were prepared on this basis, what would be the cost per week? Per year? According to Richards' table, what would be the minimum annual income with such a food expenditure?

8. In Chicago a similar experiment was carried on at a daily cost of $.45 for food. On this basis, what would be the annual minimum income?

9. If summarized household accounts for your family for the past year are available, find the per cent. of the income spent on each division of the budget in your home.

10. If you have an allowance, make out a list of all the items for which you have spent your money during the last two months,

and from this make a budget. Choose your own budget headings, and tabulate the results.

11. Make out an itemized list of all the money that your family has spent for your clothes, car fare, education, amusement, and health, during the past year. Tabulate these expenditures according to such budget headings as you may choose, and estimate the allowance you would need if you were allowed to pay all your personal expenses.

12. In a similar way estimate your budget for a year in college or normal school, including fees, travelling expenses, board, and books.

Incomes in the United States

The problem of providing for the needs of a family on a small income is one that is common to the majority of families in the United States. This fact is shown by the figures in the following tables. Although they are based on data gathered before the increase in wages due to the Great War, nevertheless since the cost of living also increased, the fact still remains that a large per cent. of the families of the United States subsist on relatively small incomes.

EXERCISE VI

1. If there are approximately 27,945,000 families in the United States, find the total number of families in each income group according to the following table:

The Estimated Percentage Distribution of Income in the Continental United States in 1910*

Family income	Percentage of families having given incomes
Under $700	38.92
700 to 1,199	42.77
1,200 to 1,499	8.62
1,500 to 1,999	4.55
2,000 to 3,999	3.53
4,000 to 9,999	1.15
10,000 to 9,999	.40
50,000 to 1,999,999	.0598
2,000,000 to 50,000,000	.0002

* Adapted from King's *The Wealth and Income of the People of the United States.* Used by permission of and special arrangement with the Macmillan Company, Publishers.

2. Find the total number of incomes that paid income taxes according to the following table:

TABLE OF INCOMES ON WHICH TAXES WERE PAID IN THE UNITED STATES IN 1914.

(Compiled from reports of income taxes).

Annual income	Number of incomes in each class
Exceeding $500,000	174
$100,000 to $500,000	2,174
20,000 to 100,000	28,509
10,000 to 20,000	49,931
5,000 to 10,000	127,448
3,000 to 5,000	149,279

3. Find the per cent. of incomes in the above table exceeding $500,000.

4. Find the per cent. of incomes in each of the other income groups.

5. If it is assumed that each of the incomes in the above table represents the income of a family, and if, as has been estimated, there were approximately 27,945,000 families in the United States, how many family incomes were below $3000?

GRAPHIC REPRESENTATION OF INCOMES

Some facts in regard to incomes can be made clearer by means of charts. This method of using pictures to represent numbers has the advantage of making the relative size of numbers apparent at a glance. It is a method commonly used for the purpose of calling attention to facts that might escape observation if stated numerically.

Thus the relative size of two numbers such as 3 and 5 can be represented by two lines 3 inches and 5 inches in length, respectively. In that case the inch is used as a unit. Using $\frac{1}{4}$ inch as a unit, the numbers could be represented by lines $\frac{3}{4}$ inch and $1\frac{1}{4}$ inches in length. If larger numbers are to be represented, it is convenient to use a smaller unit of measure.

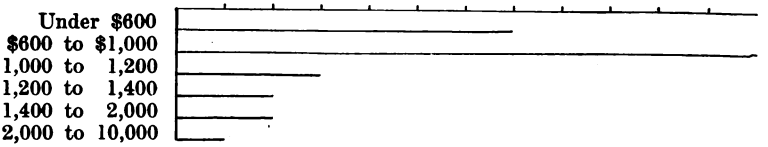
For this graphic work it is convenient to use paper ruled in squares, variously called quadrille, or cross section, or graph paper. The use of graph paper simplifies the task of measuring the length of lines since it is simply necessary to count the required number of squares.

EXERCISE VII

Problem.—Represent graphically the facts stated in the following table:

ESTIMATED DIVISION OF INCOME AMONG THE FAMILIES OF THE UNITED STATES IN 1910.[7]

Family Income	Number of Families Receiving the Stated Income
Under $600	7,000,000
$600 to $1,000	12,000,000
1,000 to 1,200	3,000,000
1,200 to 1,400	2,000,000
1,400 to 2,000	2,000,000
2,000 to 10,000	1,000,000



One-quarter of an inch, or one unit in the above chart, represents 1,000,000, and a line 1¾ of an inch, or 7 units in length, represents 7,000,000.

1. Draw a line in the above chart to indicate 5,000,000 families; 4,000,000 families.

2. Represent graphically the facts in the following table:

ESTIMATED PER CAPITA INCOME OF THE PEOPLE OF THE UNITED STATES.[7]

Census year	Per capita income
1870	$170
1880	150
1890	190
1900	240
1910	330

3. Show by means of a chart the following facts in regard to the average prices per week of labor in the various industries compared for 1894 and 1911.[7]

Prices of labor in dollars per week	1894	1911
All industries, men	$8	$11
Manufacturing, women	5	7
Manufacturing, men	9	13
Railroading	10	13
Mining	11	13
Agriculture	5	7

[7] Adapted from King's *The Wealth and Income of the People of the United States.* Used by permission of and special arrangement with the Macmillan Company, Publishers.

EXERCISE VIII

The relative change in per capita incomes in the United States during a stated period of time is shown graphically in Fig. 1.

In this chart two varying quantities are represented, time and the average amount of per capita income. Hence the chart may be called a graph of two variables. The value of each of the two

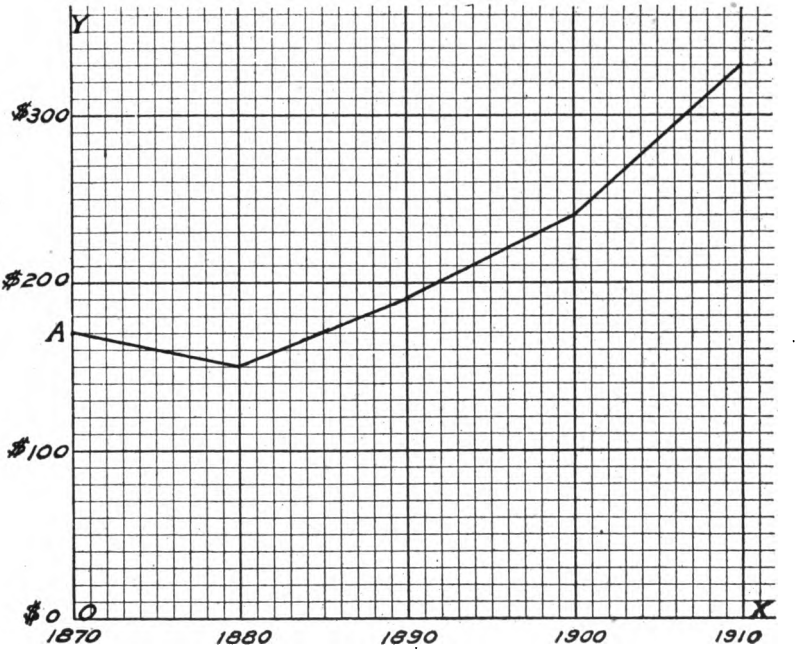


FIG. 1.—Estimated per capita income of the people of the U. S.

variables is measured with reference to two straight lines at right angles to each other, called axes of reference.

The line OX is the horizontal axis, and the line OY is the vertical axis. Each unit measured to the right of OY represents 10 years; each unit measured above OX represents $100. Thus point A which is on OY represents the year 1870. Point A is also 1.7 units above OX and hence represents $170. That is, $170 was the per capita income in the United States in the year 1870.

1. From the chart estimate the average per capita income in the United States in 1880, in 1890, in 1900.

2. If the changes in the per capita income occurred gradually, as indicated by the line on the chart, estimate from the chart the per capita income in 1885, 1888, 1895, 1899, 1905.

3. According to the chart, when was the per capita income in the United States approximately \$190? \$200? \$300?

4. If the total income (*i.e.*, the sum of all the family incomes) of a country were divided equally among the families in that country, 10 per cent. of the families would receive 10 per cent. of the income, 20 per cent. of the families would receive 20 per cent. of the income, etc. Make a chart using two variables to illustrate such a theoretical division.

Directions.—Measure the per cent. of the families to the right of the vertical axis and measure the per cent. of the income above the horizontal axis.

5. The following table shows in a general way the distribution of incomes in the United States. Illustrate by means of a graph drawn on the same chart as example 4.

ESTIMATED PERCENTAGE DISTRIBUTION OF INCOMES IN THE UNITED STATES IN 1910[8]

Percentage of families, beginning with the poorest	Percentage of total income received
7	2
26	11
39	19
51	27
61	35
75	49
86	59
98	80
100	100

ECONOMY IN PURCHASING

Thrift and economy depend in part upon skill in buying reliable goods at reasonable prices. Special prices may sometimes be secured through purchasing in large quantities, through securing a discount

[8] Adapted from King's *The Wealth and Income of the People of the United States.* Used by permission of and special arrangement with the Macmillan Company, Publishers.

by paying cash, and through purchasing at a favorable season. Small reductions in prices which considered alone might seem insignificant, result in an appreciable lowering of the expenditures if they apply to a large number of purchases.

When a reduction is secured in the price of an article, the relation between the amount of money saved and the cost of the article may be called the per cent. of saving. Thus a housekeeper makes two purchases at a sale. She buys an article worth \$1 for 95 cents and one worth 50 cents for 45 cents. On each article she makes an actual saving of 5 cents. It is easily seen, however, that the second purchase is the better bargain of the two. On the second, the 5 cents saved is 10 per cent. of the value of the article, while on the first, the 5 cents saved is only 5 per cent. of the value of the article.

EXERCISE IX

Problem.—If sugar is sold at 9 cents a pound, or 11½ pounds for \$1, what is the per cent. of saving in buying it one dollar's worth at a time?

11½ × \$.09 = \$1.04, the cost of 11½ pounds of sugar at 9 cents.
\$1.04 — \$1. = \$.04, the actual saving.
.04 ÷ 1.04 = .038, or 3.8 per cent., the per cent. of saving.

1. Oatmeal can be bought for 6 cents a pound or 10 pounds for 50 cents. What is the per cent. of saving in buying it by the 10 pounds?

2. If a pound of flour costs 9 cents, what is the per cent. of saving in buying it by the barrel at \$14? (196 pounds per barrel.)

3. If eggs cost 60 cents a dozen, what is the per cent. of saving in buying eggs by the crate of 15 dozen at \$6.45?

4. Coal is sold for \$10 a ton. A discount of 25 cents is given for payment by cash within 5 days. What is the per cent. of saving effected by paying cash?

5. What is the per cent. of saving in buying vanilla extract in a ½-pt. bottle at \$.75 over buying it in a 2-oz. bottle at \$.25? (16 oz. = 1 pt.)

6. What is the saving per lb. in buying cocoa in 5-lb. boxes at \$1.64 over buying it in a half-pound box at \$.18? What is the per cent. of saving?

7. What is the per cent. of saving in buying olive oil by the gallon at \$7.60 over buying it by the quart at \$3?

8. If 1 lb. of cornmeal can be bought for 7 cents and a 5-lb. package for 32 cents, what is the per cent. of saving in buying cornmeal by the 5-lb. package?

9. If an average saving of 5 per cent. could be realized on all purchases, find the actual saving in purchases which would otherwise amount to $10, $40, $90, $100, $500.

10. A discount of 10 per cent. is allowed on gas bills paid before the tenth of the month. Find the actual amount of money that could be saved by a family in a year if the average of the monthly bills is $6.35.

11. A store allows a discount of 2 per cent. for cash. Find the actual amount of money saved by cash payments by a family in a year if the average of the monthly bills was $43.82.

12. Bring in illustrations of ways in which your family save through buying in quantities.

13. How could three or four small families in a neighborhood reduce the cost of living through coöperation in purchasing supplies?

14. How does the public library in a town illustrate the principle of coöperative buying? The public school system? The street lighting system? The system of garbage collection?

EXERCISE X

The actual amount of increase in the cost of an article should be judged in relation to its original cost. This relation should be expressed in terms of per cent.

Thus, if the cost of flour is increased from $1 a bag to $1.05, the 5 cents increase in price is 5 per cent. of the value; if the cost of potatoes is increased from 50 to 55 cents a bushel, the 5 cents increase in price is 10 per cent. of the value.

1. The price of beans was increased from 6 to 15 cents a pound. Find the per cent. of increase.

2. Cotton-seed table oil costs 50 cents a pint or $1.60 for a 2-quart can. Find the per cent. of increase in the cost of 2 quarts of this oil purchased by the pint over the same amount purchased by the 2-quart can.

3. Through an error in estimating the amount of material needed for bias trimming on a dress, a girl bought ¾ of a yard of silk more than she needed. If she needed ½ yard, find the per cent. of increase in the cost of the bias trimming.

4. On account of the war, the cost of a ream of paper increased from 60 to 85 cents. Find the per cent. of increase and the actual increase in supplies of school paper amounting to $3800 before the war.

5. The cost of living is said to have increased 33⅓ per cent. in the 20 years before 1914. If the living expenses of a family in 1894 were $1200, what would they amount to in 1914?

6. The weight of a 10-cent loaf of bread was decreased from 22 ounces to 16 ounces. What was the increase in the cost of 22 ounces?

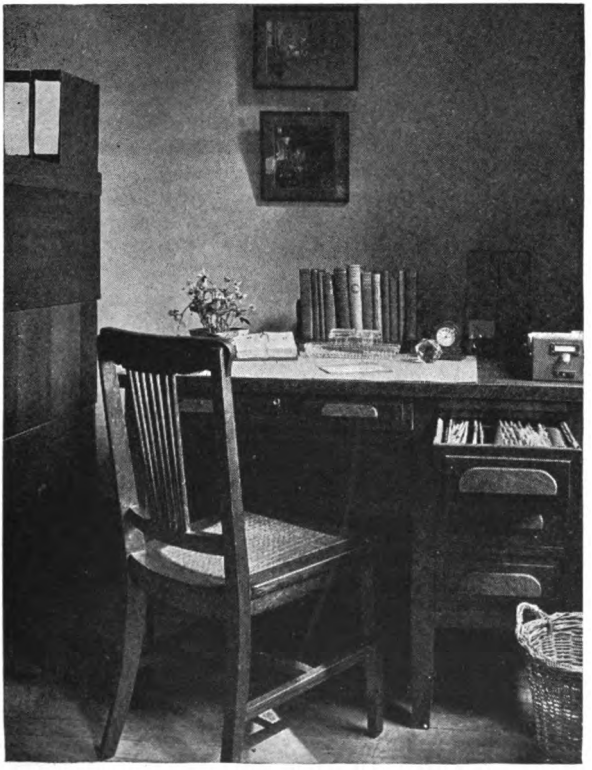


FIG. 2.—Where the business of the household is transacted.

7. At this rate, what is the increase in the month's bread bill for a large family which requires six 22-ounce loaves of bread a day?

8. Illustrate graphically by means of two variables the changes in the local prices of eggs during the last 4 months, as shown by your home grocery bills.

9. Investigate the local prices of meats, cereals, eggs, and milk, and find how much they have increased or decreased since last year at this time. Tabulate your results, and from your figures find the average increase in the cost of these foods.

10. Illustrate graphically the data in the preceding problem.

Household Accounts

Successful use of the budget system depends upon the housekeeper's assurance that the money is being spent according to the plan laid down in the budget. The only way by which she can be sure of this is by keeping a record of expenditures.

In its simplest form such a record is a cash account, or a record of cash received, cash paid, and the balance on hand.

The cash account in its simplest form consists of four columns (see page 31).

Directions

(*a*) Enter in the first column the date of each item of receipt or expenditure.

(*b*) Enter in the second column, opposite the corresponding date, the description of the various receipts and expenditures.

(*c*) Enter in the third column, opposite the corresponding descriptions, all amounts received.

(*d*) Enter in the fourth column, opposite the corresponding descriptions, all amounts paid out.

To balance the cash account: Enter the sum of the receipts and expenditures, each at the foot of the proper column, and close the account by drawing double rulings across all the columns except the second one.

The " balance " on hand is the difference obtained by subtracting the sum of the expenditures from the sum of the receipts.[9]

Enter the balance on hand as the first item of a new account, writing the amount in the column headed receipts.

[9] In cash accounts used in business, it is customary to enter the balance on hand in red ink as the last item in the column headed expenditures, thus making the totals of the two columns equal each other, or, in other words, making the columns " balance." In household accounts the balance should not be written in this column because it is desirable to keep in this column simply items of expenditure so that the footing at the end of the month will show the total expenditures for the month. The balance may be written for reference in the itemization column on the same line with total receipts and total expenditures.

EXERCISE XI

Problem.—Make the following entries in the form of a cash account and balance:

Jan.	1.	Amount of cash on hand	$20.00
Jan.	2.	Paid for washing	2.00
Jan.	2.	Paid for groceries	10.00
Jan.	3.	Paid for coal	16.00
Jan.	3.	Paid for flour	5.25
Jan.	5.	Paid for car fares	.60
Jan.	5.	Received salary	70.00
Jan.	5.	Paid for cleaning	1.25
Jan.	8.	Paid for eggs	1.40
Jan.	8.	Paid for washing	2.00
Jan.	10.	Paid for potatoes	2.25

The following is a record of these items arranged in the form of a cash account: [10]

1919	Itemization	Receipts	Expenditures
Jan. 1	Balance on hand	$20.00	
Jan. 2	Washing		$2.00
Jan. 2	Grocer		10.00
Jan. 3	Coal		16.00
Jan. 3	Flour		5.25
Jan. 5	Salary	70.00	
Jan. 5	Car fares		.60
Jan. 5	Cleaning		1.25
Jan. 8	Eggs		1.40
Jan. 8	Washing		2.00
Jan. 10	Potatoes		2.25
	(Balance on hand $49.25)	$90.00	$40.75
Jan. 10	Balance on hand	$49.25	

1. Make the following entries in the form of a cash account and balance:

Feb.	1.	Cash on hand	$75.70
Feb.	2.	Paid for washing	1.75
Feb.	2.	Paid for 3 tons of coal at $8 a ton	24.00
Feb.	3.	Paid for 4 bu. of potatoes at $1.50 per bu.	6.00
Feb.	3.	Paid for 5 doz. eggs at 42 cents per doz.	2.10
Feb.	5.	Paid for woman to clean	1.75
Feb.	5.	Paid for rent for Jan.	24.00

[10] Adapted from *Household Management*, Terrill, published by American School of Home Economics, Chicago.

Feb. 6.	Paid for 8 lbs. of beef at 28 cents per lb.	$2.24
Feb. 8.	Paid for washing	1.75
Feb. 9.	Received salary	72.00
Feb. 10.	Paid car fares	.65

2. Make the following entries in the form of a cash account and balance: [11]

Feb. 15. Cash on hand	$4.20
Feb. 15. Paid for:	
Bread	.10
Milk	.10
Steak	.10
Lunch-money	.35
Coal	.10
Bread	.20
Steak	.25
Tea	.30
Coffee	.25
Meat	1.00
Sugar (7 lbs.)	.45
Coal	.15
Feb. 16. Received from wages	14.00
Feb. 16. Paid for:	
Milk	.10
Bread	.30
Lunch-money	$ .40
Steak	.10
Milk	.05
Matches	.01
Feb. 18. Paid for:	
Meat	.45
Coal	.10
Bread	.10
Candy	.05
Beans	.10
Milk	.20
Fish	.25
Bread	.20
Lunch-money	.45
Coal	.10
Milk	.10
Potatoes	.20
Cake	.20

3. Enter the following items in the form of a cash account and find a daily balance:

Saturday, Feb. 13. Balance on hand	$13.00
Saturday, Feb. 13. Paid for:	
Rolls	.10
Milk	.08
Pork chops	.48
Rice	.06
Codfish	.20
Bread	.08
Butter	.30
Condensed milk	.90
Tea	.35
Sugar	.20
Flour	.10
Soap	.10
Soapine	.10
Gas	.25
1 pair rubbers	.65
Stockings	.35
Sunday, Feb. 14. Paid for:	
Coffee-cake	.20
Bread	$ .11
Papers	.10
Lamb	.64
Peas	.10
Potatoes	.15
Bread	.08
Sauce	.03
Bread	.16
Monday, Feb. 15. Paid for:	
Stew-meat	.34
Bread	.08
Rolls	.15
Bacon	.10
Pancakes	.20
Bread	.08
Tuesday, Feb. 16. Paid for:	
Bacon	.10
Bread	.16
Milk	.05
Meat for stew	.28
Greens	.07

[11] Adapted from More's *Wage-Earners' Budgets*, Henry Holt and Company.

Onions	$ .02
Potatoes	.10
Hash	.12
Butter	.15
Bread	.08
Stamps	.02
Papers	.06
Wood	.05
Wednesday, Feb. 17. Paid for:	
Rolls	.15
Milk	.13
Bread	.26
Bacon	.10
Beans	.10
Potatoes	.10
Fish (bloaters)	.15
Tobacco	.05
Starch	.05
Talcum	.10
Thursday, Feb. 18. Pair for:	
Bread and rolls	$ .39
Milk	.05
Pork-chops	.35
Gas	.25
Potatoes	.15
Turnips	.10
Pepper	.05
Salt	.05
Butter	.15
Friday, Feb. 19. Paid for:	
Milk	.15
Bread	.29
Potatoes	.20
Soup-meat	.30
Greens	.05
Onions	.03
Rice	.04

4. Enter the following items in the form of a cash account and balance January 18: [12]

Sunday, Jan. 12. Balance on hand	$17.00
Sunday, Jan. 12. Paid for:	
Meat	1.05
Bread	.20
Horse-radish	.05
Rice	.08
Oranges	.25
Vegetables	.06
Milk	.15
Butter	.25
Potatoes	.10
Vinegar	.02
Paper	.05
Tobacco	.05
Car fare	.25
Church money	.25
Monday, Jan. 13, Paid for:	
Car fare	.25
Coffee	.25
Tea	.16
Sugar	.18
Bread	.15
Milk	.15
Eggs	.12
Tobacco	.05
Paper	.01
Onions	.05
Potatoes	.10
Coal	.25
Rent	$4.00
Insurance	.85
Tuesday, Jan. 14, Paid for:	
Bread	.15
Milk	.15
Car fare	.25
Potatoes	.10
Tomatoes	.08
Oatmeal	.14
Paper	.01
Tobacco	.05
Meat	.20
Shoes (mending)	.30
Wednesday, Jan. 15, Paid for:	
Car fare	.25
Bread	.15
Milk	.15
Potatoes	.10
Paper	.01
Gas	.25
Coal	.25
Eggs	.14
Meat	.29
Tobacco	.05
Thursday, Jan. 16. Paid for:	
Car fare	.05
Oranges	.05
Potatoes	.10
Milk	.15
Meat	.25

[12] Adapted from More's *Wage-Earners' Budgets*, Henry Holt and Company.

Paper	$ .01	Potatoes	$ .10
Bread	.15	Rice	.08
Tomatoes	.08	Car fare	.25
Tobacco	.05	Saturday, Jan. 18. Paid for:	
Eggs	.08	Meat	.29
Butter	.13	Potatoes	.13
Slate	.05	Bread	.15
Friday, Jan. 17. Paid for:		Tobacco	.05
Fish	.15	Paper	.01
Bread	.15	Milk	.15
Milk	.15	Eggs	.08
Tobacco	.05	Onions	.05
Eggs	.08	Shoes (mending)	.30
Paper	.01	Car fare	.25

JOURNAL-LEDGER ACCOUNT

A simple cash account is of little service to the budget-maker unless the items are distributed according to the budget divisions. The distribution of the items may be done in a variety of ways; the important consideration is that it should be done in such a way that the total amount spent in each budget division may be readily ascertained.

The combination of a cash and a ledger account as illustrated on page 35 may be used for this purpose. This kind of a record is called a journal-ledger account. It admits of many variations to meet different needs.

Directions.—Use the first four columns for the account of the receipts and expenditures, or the simple cash account. (See directions for keeping a cash account on page 30.)

Increase the number of columns by as many columns as there are divisions and subdivisions of the budget, heading each with the name of one division, *e.g.,* the first, "Food," the second, "Shelter," etc.

Enter each expenditure both in the column for expenditures and in the column for the division of the budget to which it belongs; *e.g.,* enter $1.50 for sugar in the column headed "Expenditures" and in the column headed "Food."

At regularly stated intervals, preferably at the end of each week or month, balance the account of receipts and expenditures and also find the totals of the columns representing the budget divisions.

The total of the column for expenditures should be equal to the sum of the totals of the columns representing the divisions of the budget. This method of proving the accuracy of the work can be facilitated by practice in adding horizontally.

Date	Itemization	Account of		Subdivision of Expenditures										
		Receipts	Expenditures	Food	Shelter	Clothing	Operation		Advancement					Incidentals
							Service	Heat, light, etc.	Church and benevolence	Health	Insurance	Savings	Education	
Jan. 1	Balance on hand	$26.70	....	....	....	....	....	....	....	....	....	....	....	....
	Salary	150.00	....	....	....	....	....	....	....	....	....	....	....	....
2	Sugar, 15 lbs.	.....	$1.50	$1.50	....	....	....	....	....	....	....	....	....	....
	Rent	.....	20.00	....	$20.00	....	....	....	....	....	....	....	....	....
3	Coffee	.....	.70	.70	....	....	....	....	....	....	....	....	....	....
4	1 dozen eggs	.....	.60	.60	....	....	....	....	....	....	....	....	....	....
	Waist	.....	2.75	....	....	$2.75	....	....	....	....	....	....	....	....
5	Book	.....	2.00	....	....	....	....	....	....	....	....	....	$2.00	....
6	Wood	.....	3.00	....	....	....	....	$3.00	....	....	....	....	....	....
	Dentist	.....	3.00	....	....	....	....	....	....	$3.00	....	....	....	....
7	Laundress	.....	1.00	....	....	....	$1.00	....	....	....	....	....	....	....
	Electricity	.....	1.60	....	....	....	....	1.60	....	....	....	....	....	....
8	Telephone	.....	1.50	....	....	....	....	1.50	....	....	....	....	....	....
9	Supplies for house	.....	.45	....	....	....	....	.45	....	....	....	....	....	....
10	Milk	.....	1.00	1.00	....	....	....	....	....	....	....	....	....	....
	Shoes	.....	2.00	....	....	2.00	....	....	....	....	....	....	....	....
11	Vegetables	.....	2.10	2.10	....	....	....	....	....	....	....	....	....	....
	Car fare	.....	2.00	....	....	....	....	....	....	....	....	....	....	2.00
	Totals	$176.70	$45.20	$5.90	$20.00	$4.75	$1.00	$6.55	....	$3.00	....	....	$2.00	$2.00
Jan. 11	Balance on hand	$131.50	....	....	....	....	....	....	....	....	....	....	....	....

EXERCISE XII

Problem.—The following is the list of Mrs. Dale's money transactions for the first 11 days in January. Enter the items in the form of a journal-ledger account, find the balance on hand, the totals of expenditures in each budget division, and check the results. For solution see page 35.

Jan. 1.	Balance on hand	$26.70
	Received from salary	150.00
2.	Paid for 15 lb. sugar	1.50
	Rent	20.00
3.	Coffee	.70
4.	One doz. eggs	.60
	Waist	2.75
5.	Book	2.00
6.	Wood	3.00
	Dentist	3.00
7.	Laundress	1.00
	Electricity	1.60
8.	Telephone	1.50
9.	Household supplies	.45
10.	Milk	1.00
	Shoes	2.00
11.	Vegetables	2.10
	Car fare	2.00

1. Arrange in the form of a journal-ledger account the items in the family expense list on pages 32 and 33, examples 2 and 3, finding the balance at the end of the period for which the accounts are kept.

2. Obtain permission from your mother to keep her cash account for a month, under the direction of the teacher.

3. Obtain permission from your mother to keep the food account for a month, distributing the items under the following headings: Meat, milk, butter, eggs, cereals, vegetables, and miscellaneous. Find the per cent. of expenditure for each division.

Annual Summary Sheet

At the end of each month the totals of the receipts and expenditures for the various divisions of the budget should be entered on a sheet entitled "Summary of Receipts and Expenditures for the Year Ending ——." (See page 37.) On this sheet there should be one column in which the months of the year are entered in order, another for the monthly receipts, and as many more columns for expenditures as there are divisions of the budget.

At the end of the year the totals of the various columns should be found. These totals will be a classified summary of the actual

Summary of Receipts and Expenditures for the Year Ending December 31, 19—.

Months	Account of		Food	Shelter	Clothing	Operation		Advancement					Incidentals
	Receipts	Expenditures				Service	Heat, light, etc.	Church and benevolence	Health	Insurance	Savings	Education	
January...													
February..													
March....													
April.....													
May.....													
June.....													
July.....													
August...													
September													
October...													
November													
December													
Totals..													

expenditures of the family for the year just closed. This annual summary is invaluable in making a budget for the coming year.

A convenient form for the year's summary of receipts and expenditures is given on page 37.

EXERCISE XIII

1. Using a form similar to that on page 37, enter the following items which represent Mrs. Brown's expenditures for the 12 months of the year 1914 and check by horizontal addition. (The numbers in parentheses refer to months.)

Receipts.—(1) $97.35; (2) $85; (3) $85; (4) $85; (5) $40; (6) $60; (7) $95; (8) $95; (9) $95; (10) $95; (11) $95; (12) $95.

Food.—(1) $22.45; (2) $20.45; (3) $22; (4) $21.75; (5) $22.30; (6) $21.15; (7) $21.40; (8) $22.42; (9) $22.75; (10) $21.43; (11) $21.16; (12) $22.14.

Shelter.—Nineteen dollars for each month with the exception of September, when it was $18.

Clothing.—(1) $15; (2) $2.35; (3) $1.40; (4) $5.40; (5) $3.25; (6) $18; (7) $1.25; (8) $3.10; (9) $1.50; (10) $2.05; (11) $1.80; (12) $3.15.

Service.—(1) $15.50; (2) $2.50; (3) $2.50; (4) $2.50; (5) $2.50; (6) $2.50; (7) $2.50; (8) $2.50; (9) $1.25; (10) $2.50; (11) $2.50; (12) $2.50.

Heat, Light, etc.—(1) $5.65; (2) $5.59; (3) $14.66; (4) $9.02; (5) $3.80; (6) $3.40; (7) $17.40; (8) $8.24; (9) $9.52; (10) $6.87; (11) $5.50; (12) $8.03.

Church and Benevolence.—(1) $1.50; (2) $1.50; (3) $1.50; (4) $1.50; (5) ——; (6) ——; (7) $1.50; (8) $1.50; (9) $1.50; (10) $1.50; (11) $4; (12) $2.

Health.—(1) $.10; (2) $.25; (3) ——; (4) $3.25; (5) $4.10; (6) $.27; (7) $.40; (8) ——; (9) $5.10; (10) ——; (11) ——; (12) $1.10.

Insurance.—Three dollars and forty-nine cents for each month with the exception of February, when it was $18.49.

Savings.—(1) $10; (2) $10; (3) $10; (4) $15; (5) ——; (6) ——; (7) $10; (8) $25; (9) $24; (10) $22; (11) $18; (12) $20.

Education and Similar Items.—(1) $1.25; (2) $17.30; (3)

$2.75; (4) $3.25; (5) $1.40; (6) $1.10; (7) $3.25; (8) $3.25; (9) $2.75; (10) $2.25; (11) $2.55; (12) $4.75.

Incidentals.—(1) $.15; (2) $.10; (3) $3.10; (4) ——; (5) $.45; (6) $.52; (7) $.60; (8) $1.40; (9) $.50; (10) $3.10; (11) $.40; (12) $6.04.

2. According to a report of the National Industrial Conference Board of Boston, the cost of living increased during the period from July, 1914, to June, 1918, for the family of the average wage-earner in the United States from 50 to 55 per cent.

The increases for the different items were as follows:

	Per cent.
Food	62
Rent	15
Clothing	77
Fuel and light	45
Sundries	50

Using these percentages, estimate from the totals of the various items in 1 what Mrs. Brown's expenditures might have been in 1918. Assume that the family income was increased 50 per cent. Include under sundries items for service, incidentals, health, and education. Increase the amount for benevolence to include donations to the War Chest.

What amount might the family have invested in Liberty Bonds?

Personal Accounts

The journal-ledger method may be used for personal accounts. Each person will doubtless wish to modify the form in some way to suit her own needs, that is, to select a classification suited to her particular expenditures.

EXERCISE XIV

Problem.—Classify the following items of expenditures and receipts, and enter on a blank form ruled for the purpose:

May 1, on hand, $8
May 1, salary check, $25
May 4, hat, $4.50
May 5, shoes, $3.50
May 5, board, $8
May 6, 4 yds. muslin at 12½ cents a yd.
May 6, ⅜ yd. embroidery at 45 cents a yd.

Date	Itemization	Account of		Subdivision of Expenditures							
				Living expenses			Advancement				
		Receipts	Expenditures	Board and lodging	Laundry	Clothing	Health	Church, benevolence	Education	Savings	Incidentals
May 1	Balance on hand	$8.00									
1	Salary	25.00									
4	Hat		$4.50			$4.50					
5	Shoes		3.50			3.50					
5	Board		8.00	$8.00							
6	4 yd. muslin at 12½ cents		.50			.50					
6	⅜ yd. embroidery at 45 cts.		.17			.17					
9	Church		.10					$.10			
10	Car fare		.30								$.30
10	½ lb. candy at 60 cts.		.30								.30
11	Magazine		.15						$.15		
11	Stamps		.18								.18
11	Dentist		2.00				$2.00				
11	Lunch		.40	.40							
13	Laundry		.75		$.75						
May 15	Total	$33.00	$20.85	$8.40	$.75	$8.67	$2.00	$.10	$.15		$.78
May 15	Balance on hand	$12.15									

May 9, church, $.10
May 10, car fare, 30 cents
May 10, ½ lb. candy at 60 cents a lb.
May 11, magazine, 15 cents.
May 11, stamps, 18 cents
May 11, dentist, $2
May 11, lunch, 40 cents
May 13, laundry, 75 cents.

For a record of these items arranged in the form of a journal-ledger account see page 40.

1. The following is the list of the receipts and expenditures for four months for a librarian earning $70 a month. Enter them on a form similar to that used on page 40, and balance the account each month:

Jan. 1.	On hand	$1.10
2.	Received salary	70.00
	Laundry	.50
	Building and Loan Association	5.00
3.	Board and lodging	30.00
	1 silk tie	.50
	2 pair silk stockings	3.00
	1 pair white gloves	1.50
	Stamps	.25
4.	Car fare to church	.10
	Church contribution (A.M.)	.25
	Church contribution (P.M.)	.15
8.	Laundry	.60
9.	Year's subscription to magazine	4.00
	Book (birthday gift)	1.25
	Cost to mail	.05
11.	Church contribution (A.M.)	.15
15.	Laundry	.50
17.	Ticket to New York	.75
	Lunch and car fare	.90
	Corset	2.00
	Silk blouse	2.35
	Ribbon	.80
22.	Laundry	.55
	Note paper	.60
	Gloves cleaned	.10
25.	Church contribution	.25
28.	Shoes repaired	.15
	Stamps	.10
	Postals	.05
	Laundry	.60
31.	Received salary	$70.00
	Board and lodging	30.00
Feb. 1.	Church and car fare	.35
2.	Building and Loan	5.00
3.	Dressmaker's bill	6.75
	White thread	.05
	White silk	.10
	Buttons	.10
	Muslin for skirt	.50
5.	Laundry	.60
7.	Car fare	.10
	Pleasure	.75
8.	Church contribution	.25
10.	Birthday card	.15
	Bottle of camphor	.15
	Soap	.30
13.	Laundry	.70
19.	Talc powder	.19
	Shoe laces	.25
	Wash ribbon	.25
	Bodkin	.02
	Flowers (gift)	1.00
20.	Laundry	.75
22.	Church contribution	.25
27.	Laundry	.70
28.	Board	30.00
Mar. 1.	Church	.25
	Mission club	.25
2.	Received salary	70.00
3.	Building and Loan	5.00
5.	Laundry	.70
12.	Laundry	.90
14.	Ticket to New York	.75
	Lunch and car fare	.75
	Suit	22.50
	Underwear	2.25

	Gloves (black)	$1.00
	Cards (birthday)	.20
15.	Church (A.M.)	.25
	Church (P.M)	.15
19.	Laundry	.75
	Stamps	.05
	Handkerchief	.35
20.	Carriage to tea	.50
	Ruffling for dress	.25
	Shields	.15
22.	Church (P.M.)	.15
	Laundry	.60
27.	Car fare	.05
28.	Board and lodging	30.00
Apr. 1.	Received salary	70.00
	3 pair stockings	1.00
	Gloves cleaned	.10
2.	Building and Loan	5.00
	Laundry	.70
3.	Subscription to paper	5.00
5.	Church (A.M.)	.25
	Church (P.M.)	.15
9.	Hat for suit	$5.50
	Note paper	.50
	Stamps	.10
	Shoes for suit	5.00
	Silk shirt	4.00
	Doctor	8.00
	Laundry	.75
16.	Laundry	.80
18.	Pleasure	1.00
	Gift of flowers	.75
19.	Church	.25
22.	Belting (1 yd.)	.13
	Crochet cotton	.17
	Collar set	.25
	Embroidery cotton	.08
23.	Laundry	.70
25.	Board	30.00
26.	Church (A.M. and P.M.)	.40
29.	Slippers cleaned	.25
30.	Laundry	.75

2. Make out a summary sheet for the preceding account.

3. Find the average monthly expenditures for each division of the budget in the preceding account and make a budget for the librarian for the following month.

4. Enter the following items of expenditure incurred by the librarian in June. Determine how closely the totals agree with your budget estimates in example 3, and discuss the variations:

June 1.	Received salary	$70.00	June 2.	Building and Loan	$5.00
	Gloves for dance	3.00	4.	Laundry	.90
	White underskirt	3.00	11.	Laundry	.80
	Ticket to N. Y.	.75	14.	Church (A.M. and P.M.)	.40
	Lunch and car fare	.90	16.	Slippers cleaned	.25
	Crêpe de Chine for dress	7.00		Car fare	.10
	Trimming	3.00	18.	Laundry	.85
	Lining	.30		Carriage	.50
	Thread	.20		Flowers (gift)	1.00
	Hooks and eyes	.10	20.	Board	30.00
	Ribbon	.75	25.	Laundry	.90
	Ribbon (narrow)	.08	28.	Church	.25
	Making of dress	6.00			

5. Keep your own cash account for 6 weeks and make a budget from the weekly totals of expenditures.

SHELTER

SHELTER

Cost of Shelter

A house must be kept in repair: walls have to be repapered, ceilings plastered, floors recovered, woodwork painted, etc. Whether a housekeeper owns or rents her home, she should understand how to estimate the cost of repairs and maintenance, how to decide upon

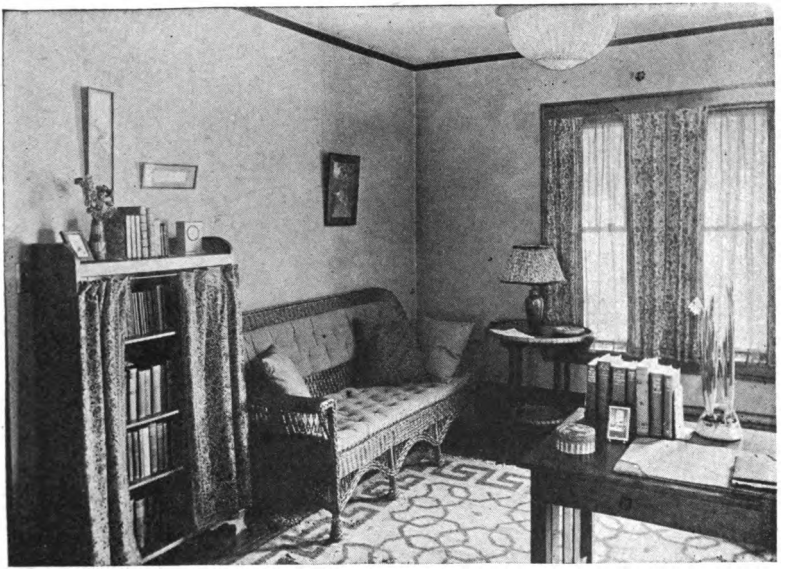


Fig. 3.—Interior of a living room.

the amount of money that may be spent upon repairs, and how to judge whether proposed alterations are essential, thus adding to the value of the property, or are luxuries.

A common rule for estimating the amount of money to be spent on repairs on rented property is the following: In order to obtain 6 per cent. income from rented property, the rent must be at least 10 per cent. of the value of the property to allow for taxes, water

bills, fire insurance, repairs, and depreciation; these last named outgoes are usually about 4 per cent. of the value of the property.

If alterations and additions are made, other than repairs, an additional rent is usually charged, equal to 10 per cent. of the cost of such additions.

EXERCISE I

1. Find the annual rent that should be charged, and the number of dollars that should be reserved each year by the landlord for taxes, water bills, insurance, and repairs, if the property is worth the following amounts: $9000, $2700, $3200.

2. What additional monthly rent would you expect to pay if a porch costing $550 were added to your home? If an extra bathroom were added at a cost of $340?

3. If a house rents for $20 a month, what is its approximate value? If it rents for $27? $17? $65?

4. The Wentworths own their own home which is valued at $9000. What should be their annual budget estimate for shelter? How much of this does Mr. Wentworth pay out of his $4000 salary?

5. Mr. Richards sets aside $14 a month to allow for repairs, taxes, depreciation, and insurance on his house which is worth $4200. If you include also loss of interest at 6 per cent. on his investment, what is the total cost of shelter per month?

6. How much should a house be worth to justify an average annual outlay of $340 for taxes, upkeep, insurance, and depreciation?

7. If your father owns your home, find the value of the property and estimate the amount that should be set aside each month for repairs, taxes, etc. Including the loss of interest, what is the cost of shelter per month?

8. If you live in a rented house, what would you estimate to be the value of the property?

Taxes

In order to pay the necessary expenses of a community, taxes are levied on the property in that community. Persons called assessors are appointed to make an estimate of the value of each person's property and to apportion the taxes according to the value of the property.

The rate of taxation is found by dividing the total estimated expenses to be paid by taxation on property, by the total assessed valuation of the property.

If the rate of taxation is 1.2 per cent. of the assessed valuation of the property, it is commonly expressed as 12 mills on a dollar or as $1.20 on a hundred dollars.

EXERCISE II

Find the taxes on property of the following value:

1. $13,500 at .0065.
2. $5420 at .0115.
3. $2600 at $1.28 per $100.
4. $6430 at $1.45 per $100.
5. A house is assessed at $3000. What will be the expense for taxes if the rate is 12¼ mills?
6. Mr. Brown owns a house and lot worth $5400. It is assessed at ¾ of its value. Find the amount of taxes on this property if the tax rate is 18½ mills on assessed valuation.
7. Mr. Johnson owns a two-family house worth $7500. The rate of taxation is $1.40 per $100 on an assessed valuation of 80 per cent. of the value of the property. What will be the amount of his bill for taxes?
8. What is the tax rate in a city which has an assessed valuation of $339,452,000 and which raises a tax of $6,420,340?
9. The assessed valuation of a village is $420,560 and the budget calls for a tax of $5420. What is the tax rate?
10. What is the tax rate in a city which has an assessed valuation of $3,124,000 if the total amount of tax to be collected is $29,450?
11. Mrs. Jones owns property in the city mentioned in the above example. It is assessed at $12,450. What is the amount of her tax bill?
12. Mr. Smith and Mr. Jackson each own property valued at $10,000. Mr. Smith lives in a city in which the tax rate is 12 mills on an assessed valuation of four-fifths of the value of the property. Mr. Jackson lives in a city where the tax rate is $1.30 per $100 on an assessed valuation of three-quarters of the value of the property. Which pays the higher tax bill? What is the amount of the tax bill of each?

13. Find out the tax rate in your own locality and the assessed valuation of the house and lot where you live. What should be the taxes on this property?

14. The assessed valuation of a certain town is $742,000. It is decided to raise the salaries of 12 teachers $200 each. What will be the increase in the rate of taxation? What will be the increase in the tax bill of Mr. Dobbins, whose property is worth $4500?

15. A city wishes to raise $12,500 for improvements. How much will this increase the tax rate if the assessed valuation of the property in the city is $36,540,200?

16. In March, 1915, Mr. Mason bought a farm house for $3500. What was the value of the house at the end of three years if the annual rate of depreciation of the property, due to wear and tear, was 1.5 per cent. of the cost?[1] What was the amount of his tax bill for the year 1918 if the rate was 7 mills on a dollar based on an assessed valuation of 50 per cent. of the value of the property?

17. Mary Jackson bought an automobile for $1200. What was the value of the car at the end of two years, allowing for an annual depreciation of 18 per cent. of its cost?[1] What were the taxes on it the second year, if the rate was $2.40 per $100 on an assessed valuation of 80 per cent. of its value?

18. Mrs. Kellogg bought a brick house in the city for $5400. What was its value at the end of 10 years, allowing for an annual depreciation of 1.5 per cent. of the cost?[1] The tax rate in the city at the end of the ten years was $1.40 per $100 on an assessed valuation of 100 per cent. What was her tax bill for the year?

Fire Insurance

Insurance is an agreement to compensate a person or persons for a specified loss. A house may be insured against fire or against loss by other means. The written agreement is called an insurance policy. The sum of money specified to be paid in case of loss is the face value of the policy.

The cost of insurance is called the premium. The amount of the premium depends upon the face value of the policy and the rate of insurance. The rate is usually quoted as so many cents per $100 for a given time, for example, a rate of 75 cents per $100 for 3 years.

[1] Depreciation rates given in *The Wisconsin Income Tax Law*. 1917.

EXERCISE III

State the premiums on the following policies at the rates specified:

1. $13,500 at 35 cents per $100.
2. $5420 at 45 cents per $100.
3. $2600 at 65 cents per $100.
4. $2050 at 50 cents per $100.
5. $8450 at 37½ cents per $100.
6. A house worth $7540 is insured for three-quarters of its value at 44 cents per $100. What is the premium?
7. Mr. Jones took out a fire insurance policy on his home for 80 per cent. of the cost, which was $3500. The rate was 60 cents per $100. What was the premium?
8. Mrs. Brown found that she could insure her house for three years for twice what it would cost her to insure it for one year. She decides to insure her house, valued at $2480 at four-fifths of its value. If the rate for one year is 45 cents per $100, what does she save by taking out a three-year policy instead of insuring it each year?
9. A house worth $3450 is insured for two-thirds of its value. What is the cost of insurance for one year at 55 cents per $100? What is the saving in taking out a three-year policy at $1.10 per $100?
10. Mr. Thompson insured his house for $4500 and his furniture for $1000. The rate was 60 cents per $100 for three years. What was the premium?
11. A house worth $2500 was insured for three-fifths of its value. It was insured for five years at 52 cents per $100 per year. During the fifth year it burned. What was the actual loss?

Expense of Owning a Home

In estimating the expense of owning a home it is necessary to consider the following things:

(*a*) The loss of interest upon the money invested in the home.
(*b*) The cost of repairs and depreciation.
(*c*) Insurance on the house.
(*d*) Taxes on the house and lot.

EXERCISE IV

1. Mr. Brown owns the house in which his family lives. The house is valued at $3000 and is insured for four-fifths of its value at 35 cents per $100 for 3 years. The assessed valuation of the house and lot is $2800. The tax rate is 12 mills on a dollar. The repairs and depreciation on the house amount to $120 a year. The lot on which the house stands is worth $300. The interest rate on money is 5 per cent. What is the expense for shelter for one year? For one month?

2. The family of Paul Jackson own their own home valued at $4000 and a lot valued at $500. They set aside $12 a month for repairs. The loss by depreciation is 1 per cent. of the value of the house. The tax rate is $1.31 on each $100 of the assessed valuation of 80 per cent. of the value. The house is insured for three-fifths of its value for 55 cents per $100 for three years. What does the family pay per month for shelter if the interest rate of money is 6½ per cent.?

3. Mrs. James can buy a house and lot suitable for her family for $3200 or she can rent a house for $20 a month and invest her money in bonds paying 5½ per cent. interest. It will cost $60 a year to keep the house in repair. The tax rate based on 75 per cent. of the value of the property is 7½ mills on a dollar. She would insure the house for $2500 at 45 cents per $100 for one year. What would be the most economical thing for her to do?

Drawings for Repair Work

The repairs on a house are of great variety. For some of these repairs it is necessary to take accurate measurements and to make drawings in order to show how the work is to be done. A housekeeper should know how to take measurements, how to draw to scale, and how to read a builder's plans.

Rules for taking measurements:

(*a*) Do not measure in the air; measure along a wall or floor, or along the ground.

(*b*) Measure in a straight line.

(*c*) If the rule used is shorter than the distance to be measured, make a light mark on the surface, at the end of the rule, and replace the end of the rule exactly at this point in continuing. In taking

the measurements of rooms it is desirable to use a long tape—a 60-ft. one is convenient about the house and grounds.

(*d*) Give results in feet and inches.

(*e*) State dimensions in the following order: Length, width, height (or depth). The signs ′ and ″ are used to represent feet and inches respectively; thus 3 ft. 2 in. may be written 3′–2″.

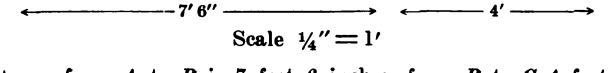
Rule for drawing to scale: Let some convenient fractional part of an inch on the drawing represent 1 foot on the actual object represented. The product of this fraction by the length of the object expressed in feet gives the length of the line in the drawing.

EXERCISE V

Problem.—Using the scale ¼″ = 1′, draw a line to represent 7′–6″.

$$7\tfrac{1}{2} \times \tfrac{1}{4}'' = 1\tfrac{7}{8}''$$

That is, the line must be 1⅞ inches long to represent 7 feet 6 inches. Measurements are indicated on drawings as follows:



Scale ¼″ = 1′

The distance from *A* to *B* is 7 feet 6 inches, from *B* to *C* 4 feet. These measurements may be written 7′–6″ and 4′–0″, or 7 ft. 6 in. and 4 ft. On drawings it is customary to use the former, in ordinary written records the latter.

In builders' drawings openings in the wall, such as windows and doors, are usually indicated on the floor plan as in Fig. 4. Distances are measured from the wall to the middle of the opening, and from the middle of one opening to the middle of the next, etc.

The distance from *A* to *D* is found by adding the distance from *A* to *B*, the center line of the window, which is 2′–6″, the distance from *B* to *C*, which is 5′–0″, and the distance from *C* to *D*, which is 3′–6″. The total length of the room is 3′–6″ + 5′–0″ + 3′–6″ or 12′–0″. The width of the room is 9′–6″. These dimensions are usually written using the sign × to express the relation "by," thus: 12′–0″ × 9′–6″.

Using the scale ¼″ = 1 foot, make floor plans of the following rooms, indicating the location of doors and windows:

1. A garage 12′–0″ × 8′–6″, with one window 3′–0″ wide, at the rear and a door 6′–0″ wide opposite the window.

2. A room 18′–0″ × 16′–6″, with two windows 3′–0″ wide on each of two sides, and a door 3′–6″ wide on the third. (Space windows and doors symmetrically.)

3. The schoolroom.

4. Your own bedroom.

5. If the garage in No. 1 is 10′–6″ high, with a flat roof, and the door is 8′–6″ high, make a drawing, *i.e.*, an elevation, of the front.

6. Make an elevation of a wall 17 feet long and 8 feet high with

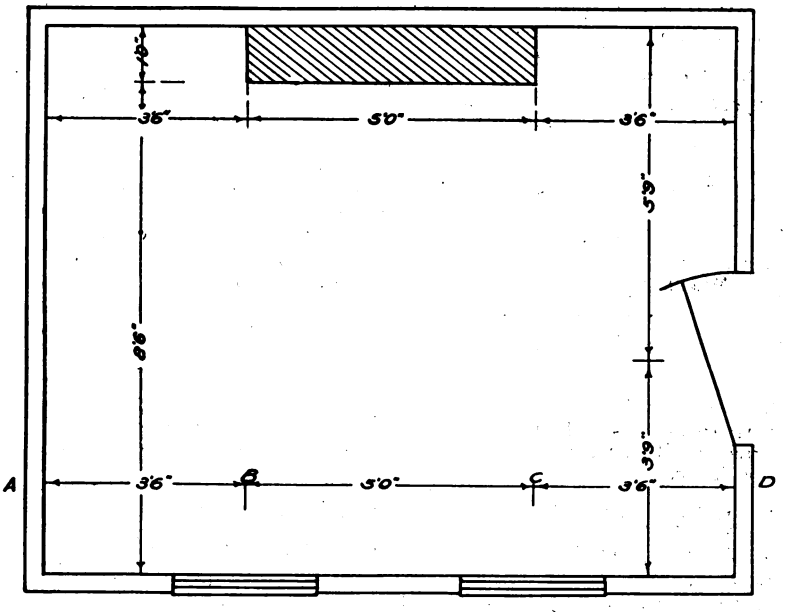


FIG. 4.—Floor plan.

two windows each 3 feet from the floor. The dimensions of the windows are 3′–6″ × 4′–6″. They are spaced symmetrically and there is 7 feet between the centre lines of the windows.

REPAIRS

Certain kinds of work are done at a specified price per square foot or square yard. For such work, it is necessary first to find the total area of the surfaces to be covered, and then to make allowances for openings according to the local custom.

EXERCISE VI

Problem.—Find the cost of lathing and plastering a hallway whose dimensions are 45′–0″ long, 14′–0″ wide, and 10′–0″ high, at 38 cents per sq. yd., no allowance being made for openings.

$45 \times 2 + 14 \times 2 = 118$, the number of feet in the length of the walls.

$\frac{118 \times 10}{9} = 131\frac{1}{9}$, the number of sq. yds. in the walls.

$\frac{45 \times 14}{9} = 70$, the number of sq. yds. in the ceiling.

$131\frac{1}{9} + 70 = 201\frac{1}{9}$, the number of sq. yds. to be plastered.

$201\frac{1}{9} \times \$.38 = \$76.42$, the cost of plastering the hall.

1. Estimate the cost of lathing and plastering a kitchen 16 ft. long, 10 ft. wide, and 8 ft. high, at 45 cents per sq. yd., no allowance being made for openings.

2. Estimate the cost of calcimining the kitchen at 20 cents per sq. yd.

3. Estimate the cost of lathing and plastering a dining-room whose dimensions are 16′–0″ long, 12′–6″ wide and 9′–0″ high, at 48 cents per sq. yd., no allowance being made for openings.

4. Estimate the cost of calcimining the dining-room in problem 3 at 24 cents per sq. yd.

5. Estimate the cost of laying a concrete floor on a verandah 28 ft. long and 14 ft. wide at 18 cents per sq. ft. (4 inch concrete).

6. Estimate the cost of oiling and polishing a floor 20 ft. long and 18 ft. wide at 5 cents per square yard.

7. Estimate the cost of laying a concrete floor 4 inches deep at 17 cents per sq. ft. in a garage whose dimensions are 16′–0″ × 12′–6″.

8. Estimate the cost of laying a concrete floor at 12 cents per sq. ft. in a cellar, if the dimensions of the foundations are 40′–0″ × 22′–6″.

9. Two concrete tracks, each 1′–8″ wide, are to be laid for an automobile driveway from the garage to the street, a distance of 85 ft. Prices quoted for different grades of concrete are 18 and 22 cents per sq. ft. Find the total cost and the total difference between the two estimates.

PAINTING

EXERCISE VII

Rule.—(*a*) To find the approximate number of gallons of liquid paint required for two coats, divide the number of square feet by 200.[2]

(*b*) A fair day's work for a painter is 1000 square feet.

1. How many gallons of paint are required for two coats of paint for a floor 16 ft. long and 14 ft. wide?

2. How long will it take a painter to give two coats of paint to the floor of a verandah 20 ft. long and 6 ft. wide? How much paint is required?

3. How much paint is required to give two coats of paint to the walls of a kitchen whose dimensions are 12 ft. long, 10 ft. wide, and 8 ft. 6 in. high? How long will it take a painter to do the work? (No allowance made for openings.)

4. How much will the paint cost at $2.50 per gallon, for two coats of paint on the outside (not including the roof) of a garage whose dimensions are 14′–4″ long, 8′–6″ wide, and 10′–0″ high? How long should it take to do the work?

5. If a painter charges $4.50 per day, and paint costs $2.25 per gallon, how much will it cost to give two coats of paint to the outside of a club building whose dimensions are 60 ft. long, 40 ft. wide, and 24 ft. high? Do not include the roof.

6. Estimate the cost of two coats of paint for the verandah floor of your home.

7. Estimate the cost of giving the kitchen wall and ceiling in your home two coats of paint.

FLOORING

In laying floors, matched boards, *i.e.*, tongued and grooved boards, are ordinarily used. These vary from ½″ to 13/16″ in thickness and from 2″ to 4″ in width, and are sold by the board foot. Prices for flooring are usually given per M, that is, per 1000 board feet.[3]

[2] It is impossible to estimate the amount of paint accurately by any one rule, for the amount of paint required varies according to the thickness of the paint, and the condition and character of the surface to be covered.

[3] All lumber is sold by board measure. For boards one inch or less in thickness the number of board feet in a board is the same as the number of square feet in its surface. For a table of board measure for boards more than 1 inch in thickness the student is referred to any complete arithmetic or encyclopedia.

In estimating the amount of flooring needed to cover a given area, allowance must be made for workage and for waste. Workage is the loss in the process of manufacturing matched boards from rough material. A piece of rough board 2½ inches wide will cover only 2 inches after it has been tongued and grooved, a board 3 inches wide only 2½ inches, a board 4 inches wide, only 3½ inches, or 3¼ inches.

Waste is the loss in laying the floor, due to imperfect boards, cutting corners, and loss of short lengths.

EXERCISE VIII

In estimating the amount of flooring needed to cover a given area, allowing for workage and waste, contractors use the following practical rules:

(*a*) For 2″, 2¼″, 2½″ flooring, allow one-third more than the area of the floor to be covered.

(*b*) For 3″ or 4″ flooring, allow one-quarter more than the area of the floor to be covered.

Problem.—How many feet of flooring 13/16″ × 2½″ will be required for a floor 18′–0″ × 16′–6″? Find the cost, using clear maple at $54 per M.

$18 \times 16\frac{1}{2} = 297$, the number of sq. ft. in the floor.

$4/3 \times 297 = 396$, the number of sq. ft. required in order to allow for workage and waste.

$\frac{54}{1000} = \$.054$, the cost per board foot.

$396 \times \$.054 = \$21.38$, tho cost of the boards.

Find the number of feet of flooring ½″ × 3″ required for floors whose dimensions are as follows:

1. 14′–0″ × 10′–0″.
2. 16′–0″ × 14′–0″.
3. 15′–4″ × 12′–6″.
4. How much matched flooring 13/16″ × 2½″ will be required for the floor in the plan on page 52? Find the cost of the flooring if clear maple is used at $49 per M.
5. Find the cost of boards for a floor 16′–0″ × 14′–6″ if clear quartered oak ½″ × 2″ is used at $108 per M.
6. Find the cost if plain oak flooring ½″ × 2″ at $49.60 is used for the floor in example 5.

7. The dimensions of a basement laundry are 14′–6″ × 10′–8″. How much will the flooring cost if N. C. pine 13/16″ × 4″ is used at $31.50 per M.?

8. Estimate the cost of laying a floor 30′–0″ × 18′–6″, using clear quartered oak flooring ½″ × 2½″ at $90 per M.

The following is a contractor's estimate of the cost of laying flooring (exclusive of the cost of the boards):

Labor to lay 1 sq. ft. @ $4.50 per day	$.04
Labor to plane and scrape @ $4.50 per day	.02
Cost of felt, nails, and sandpaper per sq. ft.	.0075
Cost of labor and material for two coats white shellac per sq. ft.	.03

9. Using the above contractor's estimate for laying floors and including the cost of boards, find the cost of laying a floor 16′–0″ × 14′–6″, using clear No. 1 maple, 13/16″ × 3″, at $49.50 per M.

10. Using the above contractor's estimate for laying floors and including the cost of boards, find the cost of laying a floor 12′–0″ × 10′–6″, using N. C. pine ½″ × 2½″ at $45 per M.

11. In the same way estimate the cost of laying a quartered-oak floor in a room 18′–0″ × 16′–10″, using material 13/16″ × 2½″ at $108 per M.

Papering

Wall-paper is usually 18 inches wide It is sold by the single roll, which is 8 yards long, and by the double roll, which is 16 yards long. Estimates for the amount of paper required and for the cost of hanging the paper are usually based upon the single roll as the unit of measure (Fig. 5).

Cartridge, ingrain, plain duplex, and velour papers are 30 inches wide, and only two-thirds as many rolls are needed as with ordinary paper.

The fractional part of a roll cannot be bought.

It is important to know that, unless otherwise specified, a roll always means a single roll.

Practical rules for estimating approximately the number of rolls of paper required for the walls and ceiling of a room are as follows:

Rule I (for walls).—(*a*) To find how many strips can be cut

from a roll, divide the length of the roll by the height of the wall and discard the remainder.

(*b*) To find the number of strips required, divide the number of feet in the perimeter of the room by 1½ feet (18″), and consider any fractional strip in the result as equivalent to another whole strip.

(*c*) To find the number of rolls required, divide the number of strips required by the number of strips that can be cut from a roll, and consider any fractional roll in the result as a whole roll unless deductions are to be made for doors and windows.

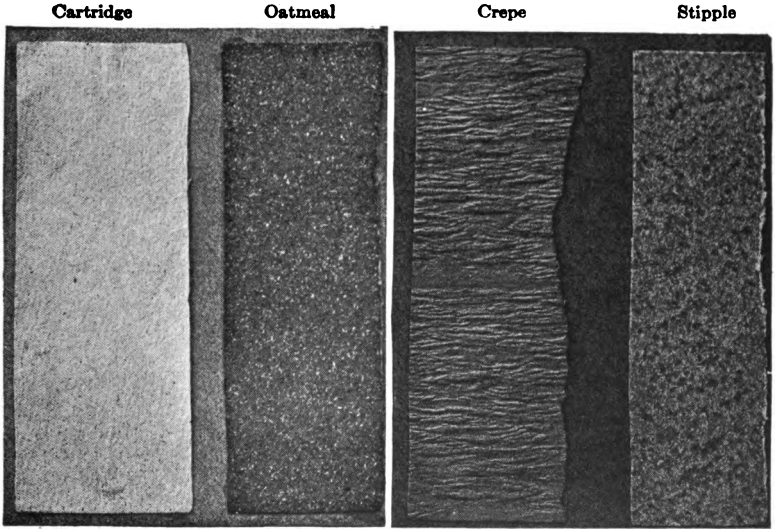


FIG. 5.—Samples of wall-paper.

(*d*) To find the number of rolls required when there are openings in the walls, deduct from the total number of rolls required one-half of a roll for each ordinary door or window; when there are large openings such as mantles or fireplaces, deduct one roll for each 36 square feet of surface in the opening.

RULE II (for ceilings).—To find the number of rolls for ceilings proceed as in Rule I, except that in (*b*) the number of strips is found by dividing the width or the length of the room in feet by 1½, *i.e.*, the width of the paper in feet.

EXERCISE IX

Problem.—Find the number of rolls of paper required for the side walls of a room 19′ × 16′ × 9′ that has 2 doors and 3 windows.

$8 \times 3 \div 9 = 2+$, that is, 2 strips can be cut from a roll.
$(19 + 16) \times 2 = 70$, the number of feet in the perimeter.
$70 \div 1\frac{1}{2} = 46+$, that is, 47 strips are required.
$47 \div 2 = 23\frac{1}{2}$, that is, $23\frac{1}{2}$ rolls are required.
$(2 + 3) \times \frac{1}{2} = 2\frac{1}{2}$, that is, $2\frac{1}{2}$ rolls may be deducted for openings.
$23\frac{1}{2} - 2\frac{1}{2} = 21$, the number of rolls required.

If double rolls are used, the paper can sometimes be cut to better advantage. Thus, in the above problem, if double rolls are used:

$16 \times 3 \div 9 = 5+$, that is, 5 strips can be cut from one double roll.
$47 \div 5 = 9\frac{2}{5}$, that is, 10 double rolls are required.

$2\frac{1}{2}$ single rolls may be deducted for openings, or 1 double roll.

Thus 9 double rolls (equivalent to 18 single rolls) are required. In other words, a saving of 3 rolls is effected by using double rolls.

Find the number of rolls of paper required for the side walls and ceilings of the rooms whose dimensions are as follows:

1. 16 ft. long, 14 ft. wide, and 8 ft. high.

2. 12 ft. long, 10 ft. wide, and 8 ft. high.

3. 14 ft. long, 12 ft. 6 in. wide, and 8 ft. 6 in. high.

4. 21 ft. 10 in. long, 17 ft. 4 in. wide, and 9 ft. high.

5 Would there be any advantage in estimating by the double roll in problems 1–4?

6. A paper-hanger charges 30 cents a single roll for hanging paper. Find the cost of papering the side walls and the ceiling of a room 14 ft. 6 in. long, 12 ft. wide, and 8 ft. 6 in. high. There are four windows and one door. Paper for the walls costs $.50 per single roll, and for the ceiling $.30 per single roll.

7. Find the cost of papering a room 32 ft. long, 19 ft. 8 in. wide, and 8 ft. 6 in. high, with paper at $.65 a roll, using $.35 paper for the ceiling, if the estimate for hanging is $.30 a roll. There are five windows in the room, a fireplace 7′–6″ × 6′–2″, and two double doors each 6′–2″ × 6′–8″.

8. Find the cost of papering a room 20 ft. long, 16 ft. 6 in. wide, and 9 ft. high, if the estimate for hanging is 30 cents a single roll. Estimate on using cartridge paper at 40 cents a roll, and ceiling paper at 30 cents a roll. There are four windows in the room and one door.

9. Make a floor plan of one room of your home and estimate the cost of repapering this room.

OPERATION

OPERATION

THE work of the home may be considered as a business with the housewife as manager. This business is concerned with providing for the family shelter, food, clothing, and also those things which make for its advancement. For this business certain operating expenses are necessary. These include the following: Maintenance of the proper equipment of the plant, such as furniture, household linen, kitchen utensils, etc.; heating and lighting of the home; household supplies, such as cleaning materials; telephone; wages paid for service; and all other expenses connected with the running of the home plant.

EXERCISE I

1. Mrs. Jones made the following expenditures for operation: Heat, $58; light, $35; telephone, $24.50; refurnishing, $40.25; wages, $200; household supplies, $98.25. What per cent. of the total was spent for each item?

2. Mrs. Brown, whose annual income is $2000, requires for the year 9 tons of coal at $7.25 a ton. She pays, on the average, $3.50 a month for gas and electricity, and $2 a month for the telephone. Four per cent. of $850, the value of the furniture, is needed to keep the furniture in repair, and $5 a month is needed for supplies. If the remainder of the budget allowance of 15 per cent. of income for operation can be spent for service, what can she afford to pay per week for service?

3. Mrs. Brown wishes to hire a maid at $4 a week in order that she may have more time for the care and education of her children and for reading. If she does this, by what per cent. of the total income will she exceed the ideal budget allowance for operation? Under which of the budget headings could she classify this excess expenditure for service?

4. If the 15 per cent. allowed for operation is divided in the following manner: 5 per cent. for wages, 4 per cent. for heat, 2½ per cent. for telephone and supplies, 2 per cent. for refurnishing,

and 1½ per cent. for light, find the yearly allowance for each item for a family whose income is $1850.

5. What would be the monthly allowance for light? Could a maid be hired on the allowance for service? If not, how many hours of service at 20 cents per hour could be procured per week?

6. Mr. and Mrs. Hanson had furniture valued at $350 when they were married. They increased this amount by $54 the first year, and $45 the second year. What was the value of the furniture at the end of the second year, allowing 7 per cent. a year for depreciation? (Allow full value for the furniture purchased the second year.)

7. A dining-room rug, worth $30, and a living-room rug, worth $45, were given them for wedding presents. The first year they bought two rugs for the bedrooms, worth $8 and $10 respectively, and the second year a rug worth $5. What was the value of the rugs at the end of the second year, allowing for an annual depreciation of 8 per cent.?

8. The other furnishings with which they started housekeeping, including bedding, curtains, kitchen utensils, etc., cost $125. Allowing for an annual depreciation of 10 per cent. and an annual outlay of $15 for new furnishings, what was the value of these furnishings at the end of two years?

9. At the end of the second year they insured the household goods for 75 per cent. of their value at 45 cents per $100 for three years. What was the premium?

10. What was the bill for taxes on this furniture, if the rate was 13 mills on a dollar based on an assessed valuation of 45 per cent. of the value of the property?

11. If the depreciation on all the household furnishings of the Hansons averages about 8 per cent., what annual allowance must be made for furnishings in order to keep the value of the furniture equal to its value at the end of the second year?

12. If the expense of repairs, replacement, taxes, and insurance on household furnishings is equal to 10 per cent. of their value, how much money can a family with an income of $1500 afford to have invested in them, allowing 3 per cent. of the income for their upkeep?

13. James Oswald expects to be married in October, when he will have an income of $2000 a year. How much money ought

he to have saved for buying the furniture? (Use the percentages suggested in the preceding problem.)

14. Make a list of the articles of furniture that he might buy for that amount.

15. When a claim for insurance is made, insurance companies usually require an inventory of the furniture destroyed. The following is an inventory of the furniture in a living room:

Article	Date of Purchase	Cost Value March '18
Rug 9′ × 10′	May, 1915	$35.00
3 pictures	May, 1915	18.00
Oak table	May, 1915	15.00
Curtains	Oct., 1915	4.45
Bookcase	May, 1916	9.75
Oak armchair	Sept., 1916	20.00
Oak chair	Sept., 1916	8.50
Oak desk	Dec., 1916	23.50
Rocking chair	May, 1917	15.00
Books	(Value May, 1915)	32.50

If 7 per cent. per year is allowed for depreciation on the furniture, 20 per cent. on the curtains, 5 per cent. on the books, and 8 per cent. on the rugs, what is the estimated value of the household goods in March, 1918? How much insurance should be taken out at this time?

16. Make an inventory of the furniture and furnishings in your living room at home giving the present value, allowing for depreciation.

Household Linens, Bedding, and Curtains

The household linen may be made at home or purchased ready-made. If it is made at home, the housewife should be able to estimate the amount of material required for the different articles that she wishes to make (Fig. 6).

In order to buy wisely it is necessary to know the difference in cost, reckoned in terms of money expended, between the ready-made article and the homemade one of the same grade. Knowing this, the housewife can estimate how much or how little she earns by her labor on the articles that she makes at home, and on which ones she earns the most in proportion to the time consumed.

In January and February there are sales of white goods. It is wise for the housekeeper to plan to buy her sheets, towels, table linen, etc., at this time.

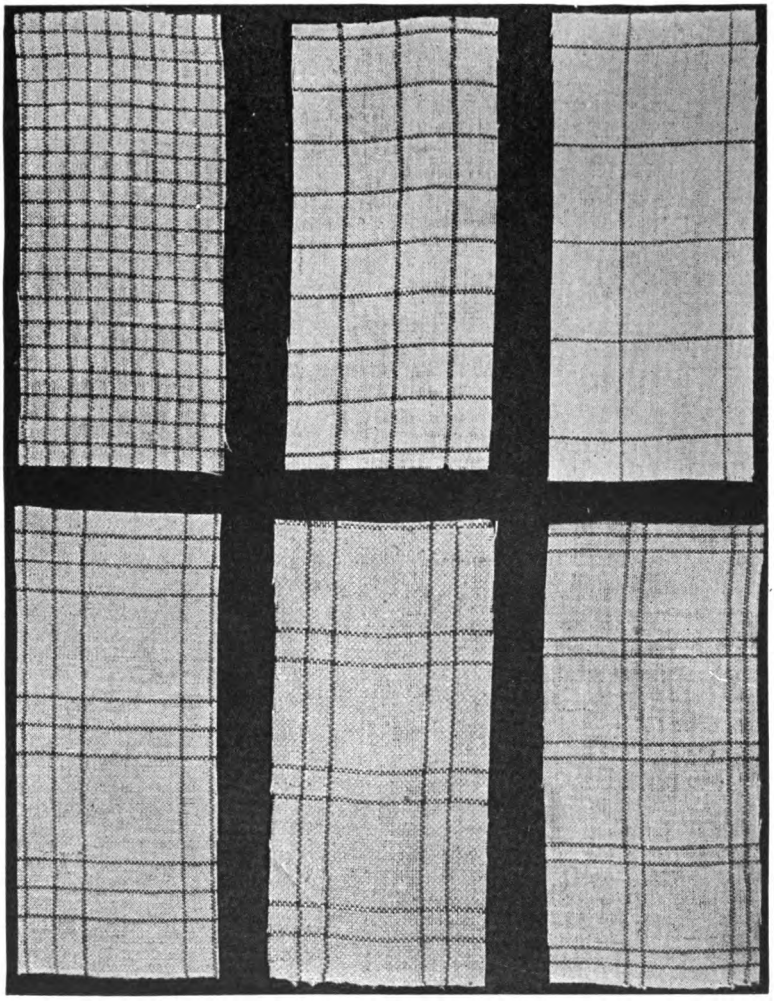


FIG. 6.—Samples of checked toweling, often called glass toweling.

The usual length of a sheet before hemming is 90 inches. Long sheets, 99 inches in length, or extra long sheets, 108 inches in length, may be bought. Pillow cases and towels are usually about

36 inches in length. Unless otherwise specified use 90 inches for sheets and 36 inches for pillow cases and towels in the examples in the following exercise.

EXERCISE II

1. If three-quarters of a yard is allowed for one dish-towel, estimate the cost of a dozen towels made from glass toweling at 19 cents per yard.

2. If the same grade of towels may be bought for $2.75 a dozen, how much does the housewife earn when she makes a dozen towels?

3. If huckaback (Fig. 7) for hand towels may be bought for 45 cents a yard, and towels made of the same grade of huckaback may be bought for 50 cents each, how much money is saved by making a dozen towels at home? (Fig. 8).

4. Find the cost of 6 pairs of sheets made from bleached sheeting at 37 cents a yard.

5. If unbleached sheeting, which is more durable, may be purchased for 32 cents a yard, what is the saving in cost? What is the per cent. of saving?

6. Find the cost of four pairs of sheets for a single bed, if the sheets are made from anchor sheeting 54 inches wide at 30 cents per yard.

7. Anchor sheets 54 in. $\times$ 90 in. may be purchased for 72 cents each. Can the housekeeper afford to make her own sheets if the quality of the ready-made sheets is the same as that of the sheeting purchased by the yard?

8. Utica sheets 90 in. $\times$ 99 in. (the size before hemming) may be purchased for $1.35 each. Utica bleached sheeting, 2½ yards wide, costs 50 cents per yard. Is it more economical to buy the sheeting or the ready-made sheets?

9. Pillow cases may be made from tubing at 25 cents a yard or from narrow sheeting at 18 cents a yard. What does the housewife earn by sewing the seams of one dozen pillow cases made from sheeting?

10. If pillow slips can be purchased ready-made for 22 cents apiece, what does the housewife earn by making the pillow slips from sheeting?

11. Discuss the advisability of making towels and bed linen at home.

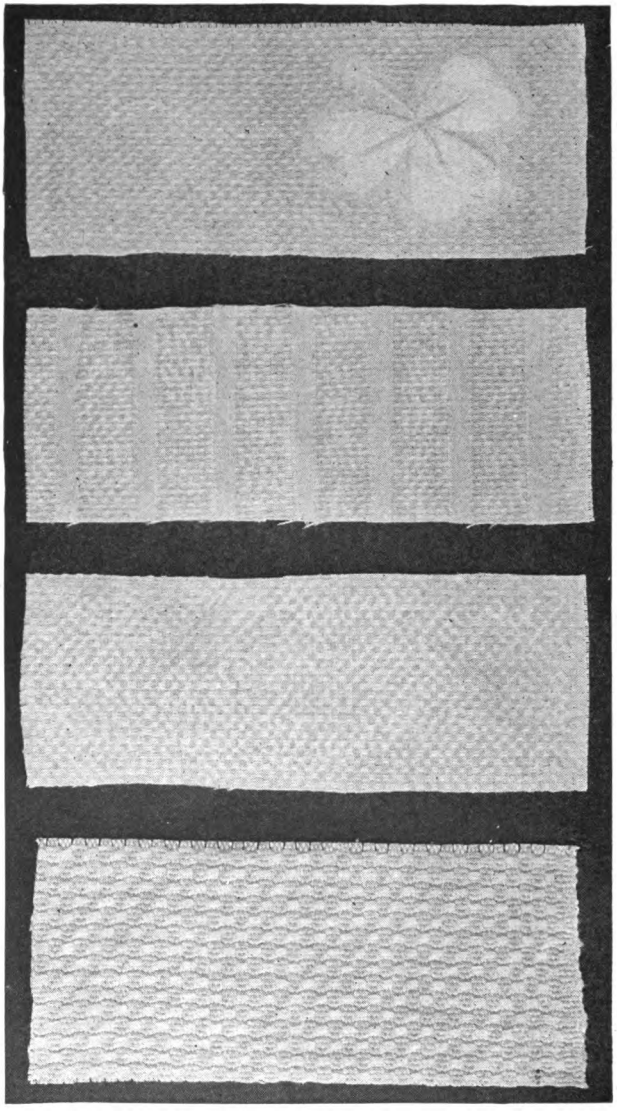


FIG. 7.—Different weaves of huckaback.

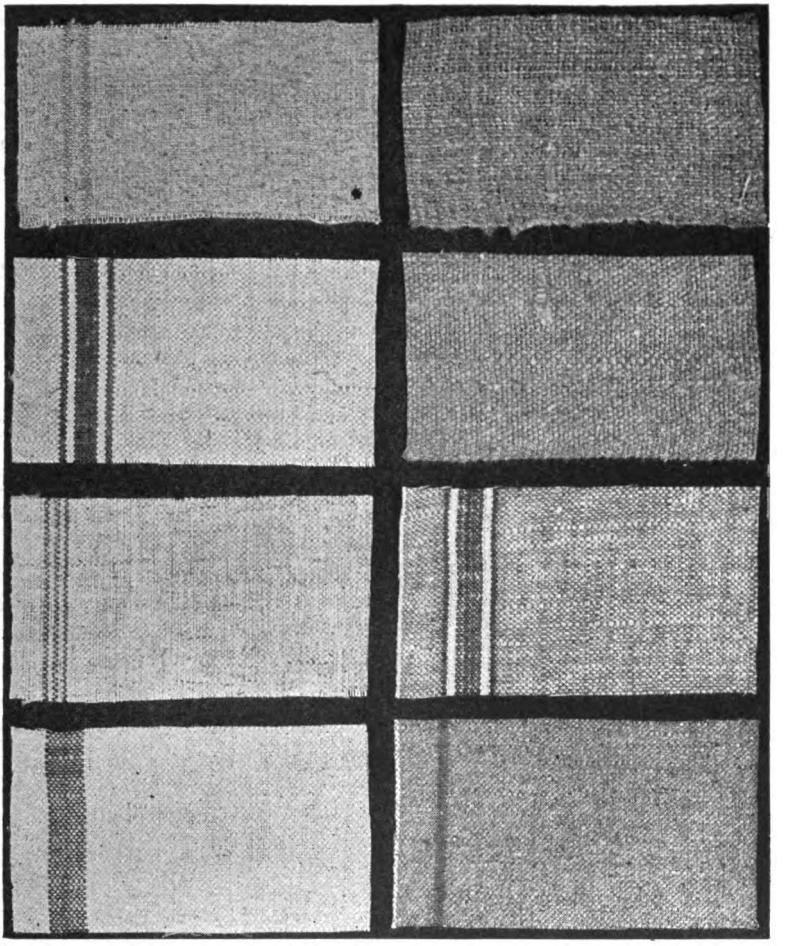


FIG. 8.—Showing different weaves of toweling.

12. The following were the regular prices and the advertised sale prices on Utica bleached sheets and pillow cases:

Utica Sheets	Reg.	Sale	Pillow Cases	Reg.	Sale
54 in. × 90 in.	$ .90	$ .65	22 in. × 36 in.	$ .25	$ .20
72 in. × 90 in.	1.05	.80			

What is the saving and the per cent. of saving in buying one-half dozen of each size of sheets and one dozen pillow cases during the January sale?

13. Find the length and width of the linen (Fig. 9) for the cloth for a dining-room table 50 inches square, if the cloth is to hang over the edge 9 inches and 2 inches are allowed on each end for a hem. Find the cost of the tablecloth at $1.25 a yard.

14. Find the length of the cloth for a dining-room table which is 60 inches long, if one-third of a yard is allowed to hang over and the hems are 2½ inches wide. Find the cost of the tablecloth at $1.50 per yard.

15. What length of material would you buy for a cloth for a 54-inch round table if one-quarter of a yard is to be allowed to hang over and the cloth is to be finished on each end with a two-inch hem?

16. Estimate the amount of canton flannel 54 inches wide needed for a silence cloth to fit the above table. What would be the cost at 50 cents a yard?

17. A circular lunch cloth 38 inches in diameter is to be trimmed with 3-inch, linen-Cluny lace. How much lace is required if the outer edge is to lie flat on the table? (The circumference of a circle is equal to approximately 3⅐ times the diameter.)

18. A circular doily 18 inches in diameter is trimmed with linen-Cluny lace 2 inches in width. How many inches of lace is required?

19. Estimate the number of yards of linen-Cluny lace 7 inches wide required for a circular lunch cloth one yard in diameter.

20. Estimate the number of yards of scrim required for curtains for three windows five feet in height. Each curtain is finished with a two-inch hem at the top and a three-inch hem at the bottom, and between the curtains at the top of one window is an 18-inch valence with the same width hems as the curtains. Allow two curtains for each window.

21. A bedroom has four windows 4 ft. 3 in. in height. Find the cost of dimity for the curtains at 25 cents per yard. Allow 1½ inches for the hem at the top of each curtain and 2½ inches for the hem at the bottom.

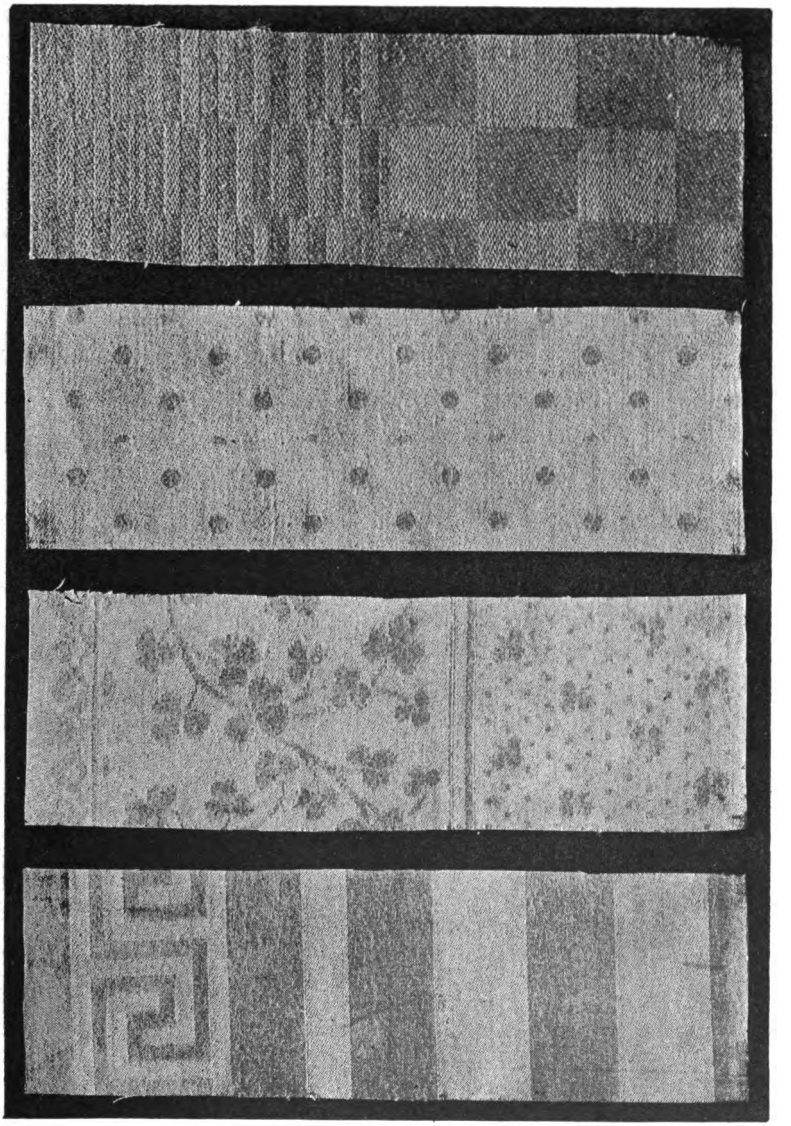


FIG. 9.—Table linens.

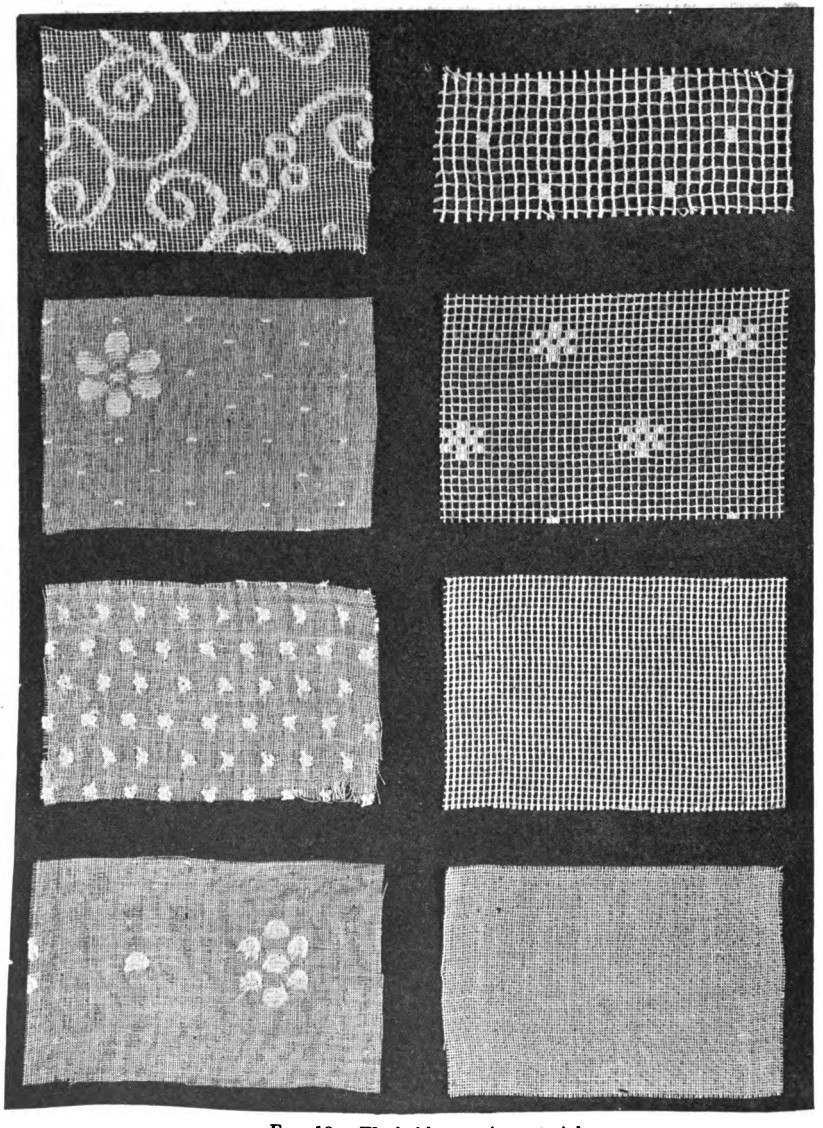


FIG. 10.—Washable curtain materials.

22. A girl wishes to make curtains for the two windows in her bedroom and a bedspread for her bed. How many yards of chintz will she need to buy, if the curtains are to be 4 ft. 8 in. long with a two-inch hem at the top and bottom of each curtain, and the bedspread is to be 90 in. × 90 in.? What will be the total cost if the chintz is 25 cents a yard?

23. Find the amount of net required for 4 curtains, each 4 feet 8 inches in length, finished with a 2½-inch hem at the bottom and a 3-inch hem at the top, allowing 3 inches for shrinkage (Fig. 10).

24. Find the amount of net required for two curtains 5 feet 2 inches in length, and a valence made of three widths of material 15 inches in depth, if both curtains and valence are finished with 2-inch hems at the bottom and 3-inch hems at the top, allowing 3 inches on the curtains for shrinkage and 1 inch on the valence.

25. Find the amount of scrim required for curtains for your own bedroom.

26. Mrs. Jones started housekeeping with the following list of household linen and bedding:

8 sheets at $1.05
8 pillow-cases at 25 cents
3 bedspreads at $2
1 dozen towels at $1.75
6 bath towels at 50 cents
12 washcloths at 12 cents
3 pairs of blankets at $8 a pair
2 wool comforters at $6
2 mattress protectors at $1.60
2 dozen 22-inch napkins at $3
1 dozen tea napkins at $6
2 two-yard-square tablecloths at $1.50 a yard
1 table pad at $1.10
4 lunch cloths at $3.50
1 dozen doilies at $5.

She reckons the average life of the table linen to be 6 years, the sheets, pillow-cases and towels 5 years, and other bedding 10 years. Make a statement in form of an inventory of the value of the articles when purchased and at end of one year. (See example 15, page 63.) What is the annual depreciation on her stock of linen and bedding? What annual allowance must she make for replacement?

Floor Coverings

Floor coverings, like cloth, are sold by the yard. To buy carpet, matting, and linoleum economically, it is necessary first to estimate the amount of material needed when the covering is laid with as little waste as possible, for a fractional part of a strip cannot be bought.

CARPETING AND MATTING

Usual width of carpets.....¾ yd. or 1 yd.
Usual width of matting.....1 yd.

Rule.—To determine the number of yards of material required:

(*a*) If the covering is laid lengthwise, find the number of strips required by dividing the width of the room in yards by the width of the covering, allowing a whole strip for any fraction of a strip in the result. Multiply the number of strips by the length of the room in yards.

(*b*) If the covering is laid crosswise, reverse the rule, using the length of the room in finding the number of strips and the width in finding the number of yards of floor covering.

(*c*) To determine the allowance for matching patterns, add to the length of each strip after the first, the allowance required for matching patterns.

EXERCISE III

Problem.—Find the cost of carpet at $.85 a yard for a room 38′–8″ × 20′–6″.

¾ yd = width of carpet.

(*a*) To lay the carpet lengthwise:

20′–6″ = $4\frac{1}{2}$ ft. or $4\frac{1}{6}$ yds., *i.e.*, 5⅚ yds., the width of the room.

$4\frac{1}{6} \div \frac{3}{4} = 9\frac{2}{9}$, that is, 10 strips are required lengthwise, and ⅑ of a strip 38′–8″ long would be wasted.

(*b*) To lay the carpet crosswise:

38′–8″ = $11\frac{6}{9}$, the no. of yds. in the length of the room.

$11\frac{6}{9} \div \frac{3}{4} = 17\frac{8}{27}$, or approximately 17⅓, that is, 18 strips are required crosswise.

⅓ of a strip 20′–0″ long is wasted, or less than when the carpet is laid lengthwise.

Hence $18 \times 4\frac{1}{6} = 123$, the number of yards required.

$123 \times \$.85 = \$104.55$, the cost of the carpet.

1. Find the number of strips of carpet 1 yd. wide required to cover a floor 15 ft. × 11 ft. if the strips run lengthwise. If crosswise. Which way will be more economical?

In rooms with the following dimensions, determine whether to lay carpeting 1 yard wide lengthwise or crosswise to avoid unnecessary waste:

2. 16 ft. × 18 ft.

3. 12 ft. × 24 ft.

4. 17 ft. 6 in. × 14 ft. 4 in.

5. Find the number of yards of carpeting 1 yard wide required to cover the floor in the plan on page 52, allowing 6 inches for matching the pattern.

6. The dimensions of a room are 19′–0″ × 16′–6″. Find the cost of carpeting this room with carpet at $1.50 a yd., allowing 4 inches for matching the pattern.

7. The dimensions of a room are 20′–6″ × 17′–8″. Find the cost of carpeting this room with carpet at $2.25 per yard, making no allowance for matching the pattern.

8. Find the cost of carpeting a corridor 42′–6″ × 6′–0″ with carpet 1 yard wide at $1.50 a yard, allowing 8″ for matching the pattern.

9. Determine the cost of laying matting on the floor of the room in the plan on page 52 at $1.15 per yard.

10. How much will it cost to carpet a floor 16′–6″ × 12′–0″ with carpet ¾ yd. wide at $1.25 per yd., allowing 8″ for matching the patterns?

11. How much will it cost to cover a floor 20 ft. long and 17 ft. wide with matting at $.85 per yard?

12. Select the kind of matting you like and find how much it would cost to buy enough for your bedroom.

LINOLEUM

Usual width of linoleum, 2 yards.

The price of linoleum is usually given per square yard, but, like carpet, it is sold by the linear yard. A strip of linoleum 1 yard long contains two square yards.

RULE.—To find the number of yards required, use the same rule as for carpets.

To find the number of square yards multiply the number of linear yards required by 2.

EXERCISE IV

Problem.—Find the cost of linoleum, 2 yds. wide, at $1.95 per square yard, for a kitchen 16′–0″ × 12′–0″.

Linoleum is 2 yards (or 6 ft.) wide.

If laid crosswise it will take $\frac{16}{6}$, or 2⅔ strips.

If laid lengthwise, it will take $\frac{12}{6}$, or 2 strips.

Hence it should be laid lengthwise to avoid waste.

Each strip will be 16 ft. long.

Then $\frac{2 \times 16}{3}$ or 10⅔ is the number of yards of linoleum required.

10⅔ × 2 × $1.95 = $41.60, the cost of the linoleum.

1. Find the cost of 18 yards of linoleum at $1.25 per sq. yd.
2. Of 14 yds. at $2.50 per sq. yd.
3. Of 25 yds. at $1.75 per sq. yd.
4. Of 17½ yds. at $2.25 per sq. yd.

Find the number of strips of linoleum needed for floors of the following dimensions if the linoleum is laid lengthwise. Crosswise. Which is the more economical way to lay it? Find the cost of the linoleum at $1.85 per square yard.

5. 21′–0″ × 18′–0″.
6. 17′–4″ × 13′–0″.
7. 17′–0″ × 15′–6″.
8. 24′–0″ × 17′–6″.
9. 23′–0″ × 11′–9″.

10. In order to use a 12′ × 15′ rug on a floor 18′–0″ × 14′–0″, a border of plain linoleum was laid, leaving the floor bare under the rug. Find the cost of the linoleum at $1.50 per sq. yd.

11. Compare the cost of linoleum at $2.15 per square yard and clear plain oak ½″ × 3″ at $49.50 per M. for a floor 27′–0″ × 59′–6″. Use the contractor's estimates on page 56 for the cost of laying the floor.

12. As in the preceding example, compare the cost of linoleum at $2.10 per square yard and clear maple 13/16″ × 2½″ at $54 per M for a floor 20′–0″ × 19′–0″.

Gas and Electricity

Fuel for lighting, heating, and cooking forms one of the large items in the cost of maintaining the home. The cost of fuel varies greatly in different localities, and depends also upon the kind of fuel as well as upon the kind of equipment used. Gas is one of the most convenient kinds of fuel, and in many localities it is cheap enough to be practicable for general use. When electricity is available at low rates, the current may be used not only for heat and light, but also for the operation of various labor-saving devices such as washing machines, sewing machines, etc. Coal, wood, coke, and kerosene oil are the kinds of fuel in common use, but as yet no satisfactory methods have been devised for measuring the amounts required for household uses.

Fig. 11.—Gas meter—index reads 79,500 cubic feet.

GAS

Gas is measured according to the number of cubic feet consumed. The rate varies in different localities, but is usually stated per 1000 cubic feet.

EXERCISE V

At 85 cents per 1000 cubic feet, find the cost of gas for the month when the following amounts have been consumed:

1. 1000 cu. ft.
2. 4000 cu. ft.
3. 500 cu. ft.
4. 3500 cu. ft.
5. 7000 cu. ft.

EXERCISE VI

Fig. 11 represents a common type of gas meter with three dials. The hand on the dial on the right moves in a clockwise direction, the hand on the next dial moves in a counter-clockwise direction, and the hand on the third, clockwise.

The first dial on the right registers hundreds up to 1000, the next registers thousands up to ten thousand, and so on. To illustrate, when the hand on the first dial has made one complete revolution it stands at zero, and the hand on the second dial stands at 1, signifying that 1000 cubic feet of gas have been measured.

If the hand points between two numbers, the lower number should always be taken.

The following pairs of numbers represent the reading of gas meters on the first days of two successive months. Draw diagrams to illustrate the two readings in each example, and find the number of cu. ft. of gas used, and the amount of the bill at 85 cents per 1000 cu. ft.:

1. 296300, 307200.
2. 321200, 330200.
3. Read one of the gas meters in school on two different days. Find the amount of gas used in the interval and the cost at the local rate.
4. Read the gas meter in your home on two successive days. Find the amount of gas used in the interval and the cost at the local rate.
5. At 90 cents per 1000 cu. ft., how many cubic feet of gas should be allowed for every quarter dropped into the "quarter meter"? At 80 cents? At $1.25?
6. Read the gas meter in your home at the beginning and at the end of a month, and determine the accuracy of the gas bills.
7. If the gas rate is decreased from 95 to 80 cents per 1000 cu. ft., what is the per cent. of saving in the gas bill? What is the actual annual saving in a home where an average of 8500 cu. ft. are used per month?
8. If you have a quarter meter in your home, read it several successive times when a quarter is inserted and determine whether or not your meter is registering correctly.

EXERCISE VII

The cost of gas for cooking and for lighting can be estimated from the number of cubic feet used per hour by different kinds of burners. The following table presents this information in compact form:

TABLE SHOWING GAS CONSUMPTION PER BURNER.[1]

Name of burner	Cost	No. of cu. ft. per hour	No. of candle power
Climax water heater	...	50	...
Oven	...	30	...
Giant	...	18	...
Star	...	12	...
Simmerer	...	4	...
Iron	$3.00	4	...
Open flame light	...	8	30
Welsbach (upright)	.50	6	50
Welsbach, inverted, C. E. Z.	1.30	3	60
Welsbach, junior	.40	3	40
No. 20 Reflex	8.25	20	300

1. By carefully planning to do all her baking on the same day, a woman found that she required the oven for three hours one day a week. If she had been using the oven on an average of an hour a day, what was the actual saving of gas per year? At $1.10 a thousand, what is the saving?

2. The laundress used the water heater four hours a day, one day a week. At 90 cents per 1000 cu. ft., how much does the cost of hot water add to the cost of labor in a year?

3. Four Welsbach lights are used to replace eight open-flame burners. If the lights are used on an average of three hours a day, find the actual saving per hour. How many hours will it take to save the cost of the Welsbach lights with gas at 95 cents per 1000 cu. ft.?

4. If six Welsbach inverted (C. E. Z.) burners are used to replace twelve open-flame burners, find the actual saving per hour if gas costs 85 cents per 1000 cu. ft. At this rate, how many hours of use would be necessary to save cost of the C. E. Z. burners?

5. Make a table showing:

(*a*) The number of cu. ft. of gas used per candle power per hour by each of the lights in table on this page (use 4 decimals).

(*b*) The cost of each light per candle power per hour at $.90 per 1000 cu. ft., or at the local rate, using 6 decimals.[2]

[1] The figures given are those furnished by The Public Service Gas Co., Plainfield, N. J. They are subject to variation due to pressure, kind of gas, and state of the burner.

[2] In making this table, allow space for similar data with reference to electric lights.

6. Represent graphically:

(*a*) The number of cu. ft. used per candle power per hour by each of the burners.

(*b*) Cost of each light per candle power per hour.

7. Using each of the different burners, find the cost per hour of lighting a building which requires about 3000 candle power.

8. After the installation of a water heater the average monthly gas bill increased from \$2.85 to \$3.30. If the gas rate is \$.90 per 1000 cu. ft., find the average number of cu. ft. of gas used in the gas heater in a month. How many hours is the heater used?

9. After buying a gas iron, the monthly bill decreased from \$4.15 to \$3.90. At this rate, what amount would be saved in a year?

10. In order to save 50 cents a month in gas, how large a reduction must be made in the number of cu. ft. of gas consumed at \$1.10 per 1000 cu. ft.?

ELECTRICITY

Electricity is not a fuel, but it may be used as a source of light, power, and heat. The amount of electricity used is measured in watts, a unit for measuring electric current. The rate is based on the number of 1000-watts used per hour, or kilowatt-hours (k. w. h.). Kilo means 1000.

An electric meter is similar to a gas meter; the hand of the first dial on the right moves to the right, the hand of the next dial moves to the left, and so on. In the electric meter, the first dial usually records units up to 10 k. w. h., the second tens up to 100, and so on. For example, the reading on the first dial in Fig. 12 is 584 k. w. h.

If the hand points between two numbers, the lower number should always be taken.

EXERCISE VIII

The following pairs of numbers represent readings of electric meters on the first days of two successive months. Draw diagrams to illustrate the two readings in each example, and find the number of k. w. h. used in the amount of the bill at \$.08 per k. w. h. (Fig. 13).

1. 346; 427.
2. 8354; 8921.
3. 518; 999.

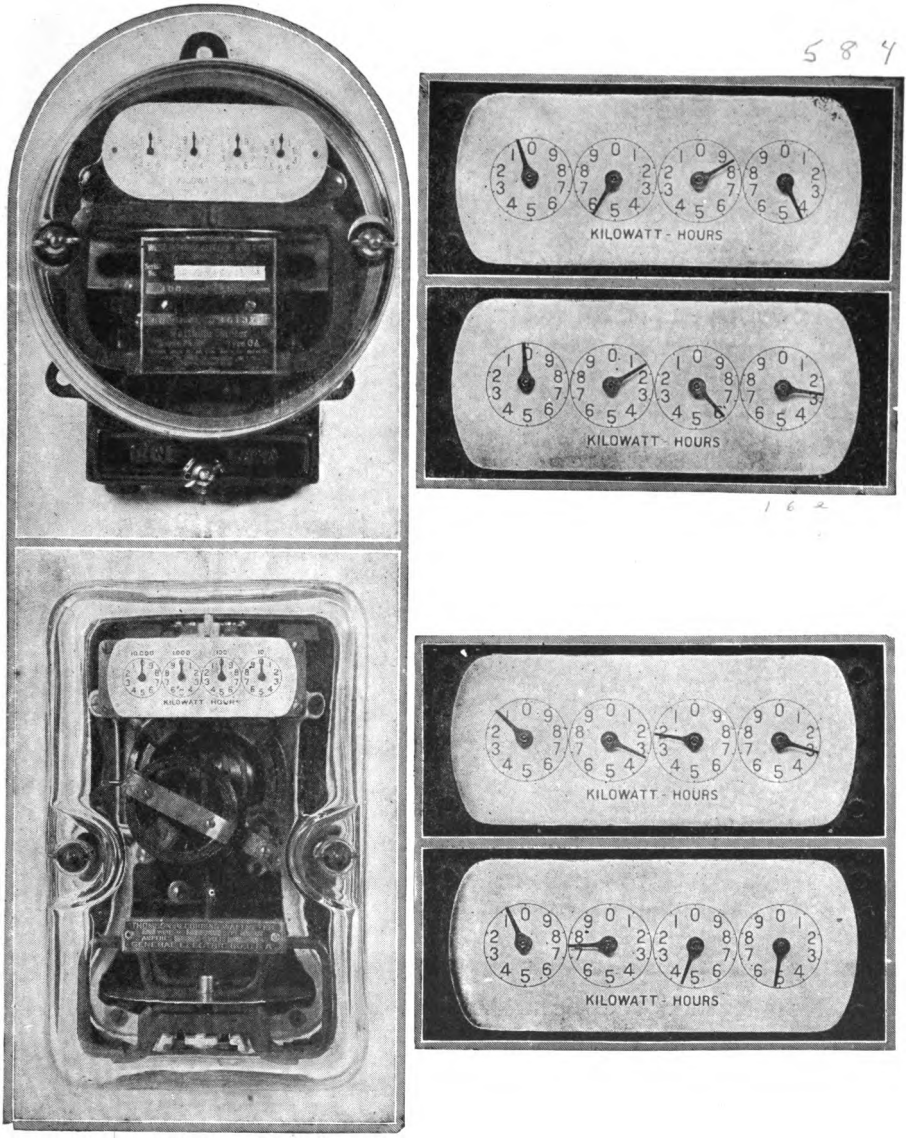


FIG. 12.—Electric meter (Courtesy Good Housekeeping Institute, N. Y. City).

4. Read one of the electric meters in school on two different days. Find the number of kilowatt hours used, and the cost at 7½ cents per k. w. h. (or the local rate).

5. The rate for electric current is reduced from 11 to 8½ cents per k. w. h. Find the per cent of saving.

6. The rate for electric current is increased from 7 to 9½ cents per k. w. h. Find the per cent. of increase. Find the actual increase for a family that used an average of 35 k. w. h. per month.

7. See Fig. 12. The second group of dials from the bottom illustrates Mr. Smith's meter at the end of the month of July. Through an accident the cover over the dial was broken and the

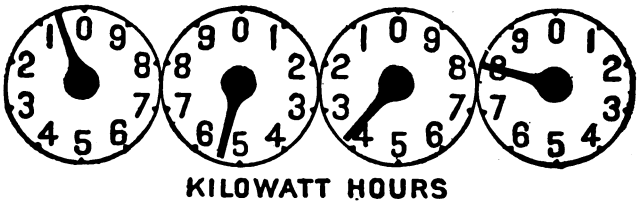


FIG. 13.—Dial of a watt-hour meter.

hand on the second dial from the right was bent so that it stood slightly to the right of the figure 2 instead of a little to the left. The man who read the meter did not discover the error. He followed the rule as given on page 78 for the reading of the meter. What difference did the accident make in the gas bill for July on the basis of 10 cents per k. w. h.?

8. Mr. Smith later discovered what was wrong with the meter and notified the company. How did he detect the error?

EXERCISE IX

Electricity is an expensive source of heat, but the amount of heat can be regulated and there is very little loss due to radiation. Moreover, it is the only source of heat for cooking which gives off no products of combustion.

The cost of electricity for heating and lighting can be estimated from the number of watts used per hour by the various kinds of electric bulbs and electric attachments.

TABLE SHOWING THE NUMBER OF WATTS USED PER HOUR BY VARIOUS ELECTRICAL APPLIANCES [3]

Name of appliance	Cost of instrument	Candle power	Watts per hour
Disk (6 in.) stove	$8.50	....	600
Disk (10 in.) stove	13.00	....	1100
Iron	3.00	....	500
Vacuum cleaner	47.50	....	135
Carbon bulb	.15	16	60
Mazda bulb	.19	12	15
Mazda bulb	.19	23	25
Mazda bulb	.19	39	40
Mazda bulb	.25	60	60
Mazda bulb	1.85	350	350
Nitrogen bulb	.44	95	75

At 9 cents per k. w. h., or the local rate, find the cost per hour of each of the following electrical appliances:

1. 6-in. disk.
2. 10-in. disk.
3. Vacuum cleaner.
4. Iron.
5. If a 6-in. disk is used instead of an ordinary star gas burner, what is the actual difference in cost per hour if the rate for gas is $.90 per 1000 cu. ft., and the rate for electricity is $.10 per k. w. h.?
6. (*a*) If a gas iron is used instead of an electric iron, what is the difference in cost per hour if the rate for gas is $1 per 1000 cu. ft. and the rate for electricity is $.12 per k. w. h.? (*b*) What will this difference amount to in a year if the iron is used eight hours a week?
7. If an electric iron is used eight hours a day, how much does the cost of the electricity at $.12 per k. w. h. add to the labor cost of the work?
8. Make a table showing: (*a*) The number of watts used per candle power per hour by each of the electric bulbs in the table. (Use two decimals.) (*b*) The cost per candle power per hour at 9 cents per k. w. h., or the local rate. (Use six decimals.)
9. Represent graphically the data in problem 8.
10. Find the cost per hour of the electricity used by each of the six kinds of bulbs in lighting a hall that requires a total illumination of about 1800 candle power.

[3] These figures were furnished by the Public Service Electric Company, Plainfield, N. J.

11. A 15-watt, Mazda bulb is used to replace a 16-candle power carbon light that is used as a night light on an average of nine hours each night. Find the actual amount saved in a year.

12. If the owner of a house replaces 24 carbon bulbs with an equal number of 40-watt, Mazda bulbs, (*a*) What is the total increase in candle power? (*b*) What is the total decrease in watts per hour? (*c*) What is the total saving per hour at $.09 per k. w. h.? (*d*) What is the total cost of the new bulbs? (*e*) What is the total number of hours' use required to save the cost of the new bulbs?

13. What is the difference in cost per 100 hours between two 40-watt, Mazda bulbs and one 75-watt, nitrogen bulb?

14. At the local rate, compare the cost of using two 40-candle power, Welsbach, junior gaslights and electric lights of about the same candle power for 100 hours.

15. Estimate the cost per hour of lighting the school assembly room at the local rate.

16. At the local rates, estimate the cost of lighting a lecture hall from 7.30 to 11 P.M. with 250 forty-watt, Mazda bulbs.

17. At the local rates, compare the cost per hour of lighting a church with eight No. 20 Reflex gaslights and with sixty 40–watt, tungsten electric light bulbs.

18. A nitrogen bulb uses about 0.8 watt per candle power. If 300 watt nitrogen bulbs are used instead of 350 watt Mazdas, what is the gain in candle power? The total saving in the cost of current per hour on 165 street lights at 5½ cents per k. w. h.? The total saving to the city per year if the lights burn eight hours every night?

19. Illustrate graphically the relative cost per candle power per hour of open-flame and Welsbach gaslights and of carbon, tungsten and nitrogen bulbs.

Household Service

In a large proportion of homes the greater part of the household work is performed by the housewife. She adds to the family income by her work as truly as her husband does by his. Although there is no increase of income as far as actual money received is concerned, nevertheless the work of the wife has a value which can be translated into terms of money.

The housewife serves not only as cook, laundress, etc., but as manager of the business. As such her services have a higher value than the services of those whom she employs. This value will vary with different families, and in different localities and will depend on the efficiency of the housewife herself.

EXERCISE X

In the following problems consider the housewife's services as worth 30 cents an hour unless otherwise stated:

1. If Mrs. Arnold spends 10 hours making a dress for her daughter, the materials for which cost $2.50, estimate the value of the completed dress.

2. Mrs. Dickens spends 35 hours a week preparing the food for the family and washing the dishes. What does she add to the annual family income by this service?

3. Mrs. Gilman is planning to buy a dress for her daughter. She can buy a ready-made dress for $15 or she can buy the materials for $10.50 and make the dress at home. If she makes the dress at home she will have to hire extra help for her housework for 16 hours at 20 cents an hour. What would you advise her to do?

4. Mrs. Simmons works 34 hours a week preparing meals and clearing them away, 9 hours buying and making and repairing clothes, 12 hours on laundry work, 9 hours on cleaning, 10 hours looking after the children, and 3 hours in planning and management. Mary, age 12, works 3 hours a week, and John, age 10, works 2 hours a week. Consider the value of Mary's work at 10 cents an hour, and John's as 8 cents an hour. How much is added to the family income by the work of these three?

5. What per cent. of the time does Mrs. Simmons spend on each kind of work? How much does her work increase the value of the food materials purchased? Of the materials for clothing and the clothing purchased?

6. Mrs. Goodwin dislikes to do laundry work and cleaning, but finds that she can write for magazines with some small degree of success. If the washing and ironing take on an average 12 hours a week, and the cleaning 6 hours, how much must she earn by her writing to pay for the services of a worker at 20 cents an hour to do this work?

7. Mrs. Johnson spends one hour twice a week in doing the

marketing, and once a week she goes to the down-town market, paying 10 cents car fare and spending two hours. She finds that by use of the telephone she can do her ordering satisfactorily, spending only two hours a week. How much time is saved? Will the value of the time saved equal the cost of the telephone at $2 a month?

8. When Mary Baker was assisting her mother with the housework, she decided to try the plan of washing dishes only once a day. She found that she saved by this means on an average of 15 minutes a day. If her time was worth 15 cents an hour, what did the saving amount to in a year?

9. Mrs. Peck had a large old-fashioned kitchen in which she wasted much time because the distances between the sink, cupboards, stove, etc., were so great. She remodeled her kitchen, arranging it according to the plan of an efficient kitchen. After doing this she found that the time consumed in preparing a meal was 10 minutes less. How much time did she save during a year? What was the value of this time made available for other uses?

10. Estimate the number of hours per week spent in your home on cleaning, dusting, and washing windows. How many hours are spent per year? At 20 cents per hour, what is the annual cost of cleanness?

11. Estimate the number of hours per day spent in the care and maintenance of your home, including everything that pertains to cleaning, cooking, marketing, and necessary repairs. What would be a reasonable rate to pay for such services in this locality? On this basis estimate the value of the increase made in the income if this work is done by members of the family. How much do you add to the family income?

12. What truth is there in the old saying, "Two can live as cheaply as one?"

EXERCISE XI

If a family has an income of $1500 or less, the 10 or 15 per cent. allowed for operation will be needed almost entirely for fuel, light, refurnishing, and household supplies. Hence little if any allowance can be made for wages paid for service.

For incomes from $1500 to $3000 a safe rule might be: Allow one-third as much for service as for rent.

For incomes above $3000, allow one-half as much for service as for rent.

Rent is usually not over one-fifth of the budget; see p. 19.

These rules are subject to many qualifications and should be applied with discretion.

Using the above rules, estimate the allowance for service for families with the following incomes:

1. $1840.
2. $3400.
3. $5000.
4. How much can a family whose income is $2800 afford to pay a week for a maid and for the care of furnace, lawn, etc.?
5. Can a family with an income of $2500 afford to pay $5 a week for a maid, if $1 a month must be paid for other service?
6. Mrs. Jackson's home is valued at $3750. How much may she allow in her budget for service?
7. A family whose total income is $2600 pays $.25 per month for removing garbage, $.20 a month for removing ashes, etc., $3 a month for 9 months for care of furnace. How much more can they spend per week for services of a woman for house cleaning and laundry?
8. Can a family with an income of $1500 afford to pay $2 a week for laundry and cleaning, if this is the only expense for service?
9. Mrs. Armstrong pays a maid $4 per week with board for 8 hours' service per week-day and 4 hours on Sunday, paying one and a half times the regular rate for overtime. During a month she required 6 hours overtime service. What did the maid receive? What is the minimum annual income to justify this expenditure?
10. Mrs. Jones has been hiring the services of a houseworker 5 hours a day for 6 days in the week at 20 cents an hour. She finds that she can get a maid for $5 a week and board. If board is worth $4.50 a week, how much more will the services of the maid cost her than those of the houseworker?
11. Compare the cost of service by the hour at 20 cents, including lunch valued at 15 cents, with the cost of service by the week at $6, including board at $5.50. Make the comparison on the basis of an 8-hour day.
12. Discuss the advantages and disadvantages of the two kinds of service mentioned in Nos. 10 and 11.

CLOTHING

CLOTHING

Personal and Family Budgets for Clothing

In planning a clothing budget, the housewife will consider two things: How much money she can afford to spend for clothing, and how to divide this amount so as best to meet the needs of individual members of the family. According to studies of budgets, 10 per cent. to 15 per cent. of the family income may be allowed for clothing. Of this amount the husband's clothing will probably claim the largest proportion, if the income is below $2000; and the wife's clothing, if the income is above $2000. The amounts allowed for individual children will vary according to age and sex. After the children reach the ages of 13 and 14 years an increasingly larger proportion will have to be spent for their clothing.

The following are suggested divisions of the clothing budgets for typical American families:

Estimated Allowance for Clothing Expressed as a Percentage of the Total Allowance for Clothing.

	Husband	Wife	Children
Income less than $2000	35%	20%	45%
Income $2000 or more	30%	35%	35%

An independent working girl or a business woman spends from 10 per cent. to 15 per cent. of her income for clothing. If her income is sufficient to allow her to spend $125 or more per year for her clothing, her budget might be divided as follows: 25 per cent. for coats, suits, and furs; 25 per cent. for dresses, waists, and skirts; 15 per cent. for underwear, nightgowns, and hosiery; 15 per cent. for hats and gloves; 10 per cent. for shoes and overshoes; 10 per cent. for sundries.

These divisions may be used in planning a clothing budget for any woman, whether she be a housekeeper, college girl, or business woman. In doing this it is well to keep in mind the needs of more than one year, as many of the articles of wearing apparel last two or three or more years. Hence a three-year basis has been found to be satisfactory in planning clothing expenditures.

EXERCISE I

In the following examples use the budget divisions suggested above, both for the family budgets and for the personal budgets.

1. The following were the expenditures for clothing for the family of a mill-worker whose income for 1910 was $401.70; Father, $31.65; mother, $22.94; daughter, age 11, $17.32; son, age 8, $10.75; daughter, age 4, $5.82; daughter, age 1, $2.27.[1] What per cent of the income was expended for clothing? What per cent. of the total amount for clothing was expended for each member of the family?

2. The following was given in 1911 as a fair standard for a clothing budget of the wife of a southern mill-worker, whose income is $600: 1 suit, $5.75; 2 percale waists, 60 cents; 1 flannelette waist, 50 cents; 2 white waists, $2; 2 duck skirts, $2; 2 calico dresses, $1.50; 2 dressing sacques, 60 cents; 2 gingham aprons, 50 cents; 2 petticoats, $1.60; 2 undershirts, 50 cents; 1 felt hat, $2; 1 straw hat, $2; stockings, $2; 2 pairs of shoes, $4; 4 handkerchiefs, 20 cents; 1 pair gloves, 50 cents.[1] Classify the above items and find what per cent. of the total is allowed for each division.

3. The following is a clothing budget. A teacher with an income of $900 a year made the following expenditures for clothing for one year: Winter coat, $20; tailor-made suit, $45; 2 hats, $5; crepe waist, $5; street dresses, $20; 2 pair high shoes, $10; 1 pair of low shoes, $4; underwear, $10; 8 pair stockings, $3.50; 2 home-made house dresses, $1.50; sweater, $3; 2 pair gloves, $4; incidentals, $3. Classify the items and find out what per cent. is allowed for each division.

4. A girl who was going to college made out the following budget for clothing for her first three years: Suits and coats, $110; dresses, waists, and skirts, $115; underwear, $70; shoes, $40; hats and gloves, $60; sundries, $45. What was the average amount allowed for each year? What per cent. of the total was allowed for each division? Make out a detailed budget of the articles that she might buy with the amount allowed for dresses, etc.

[1] *Report on Condition of Woman and Child Wage-Earners in the United States. Volume xvi: Family Budgets of Typical Cotton-Mill Workers.* 1911.

5. A girl in business with an income of $15 a week made out the following budget for her clothing for three years: $75 for two suits and one coat; $80 for dresses, waists, and skirts; $30 for underwear, nightgowns, and hosiery; $42 for shoes and overshoes; $45 for hats and gloves; $30 for miscellaneous expenditures. What would be her average expenditure for clothes each year? Each month? What per cent. of her income was she planning to spend for clothes? What per cent. of the total clothing budget did she plan to spend for each division? Make out a detailed budget for her shoes.

6. Mrs. Jackson allows $350 for the clothing for her family, consisting of the following members: Herself; Mr. Jackson; Dorothy, age 10; Helen, age 7; Robert, age 3. Apportion the allowance among the different members of the family.

7. Make out a personal budget for Mrs. Jackson, giving the amount to be allowed for each division.

8. In the family of Mr. and Mrs. Simmons there are three children: Mary, age 12; John, age 10; and Sarah, age 3. The family income is $2300. If 20 per cent. of this is allowed for clothing, how much would you allow for each member of the family?

9. Make out a personal budget for Mrs. Simmons' clothing.

10. Mr. and Mrs. Brown have an income of $1800. They plan to allow for the clothing for themselves, and their children, Harold, age 6, and Margaret, age 14, only 15 per cent. of the income. How shall the 15 per cent. be divided among the four of them?

11. Make out a clothing budget for Margaret.

12. Make an inventory of your own clothing, with the cost of each article. Find the total cost and the per cent. spent on each division.

13. The following is a suggestive list of clothing for a high school girl for one year. With this as a basis, make a budget for your own clothing for a year, using local prices. Articles which are left over from the year before may be listed without the cost:

Coats and suits:
1 sweater
1 winter coat
1 spring coat

Dresses, waists, skirts:
2 summer dresses
1 wool dress
2 white dress skirts
1 serge skirt
3 middies
1 party dress

Underwear, nightgowns, and hosiery:
3 summer vests

3 winter union suits
1 corset waist
3 combination suits
2 white petticoats
1 black petticoat
2 summer nightgowns
2 winter nightgowns
1 kimono
1 pair bloomers
6 pair stockings

Hats and gloves:
1 winter hat
1 summer hat
1 pair white gloves
1 pair wool gloves
1 pair kid gloves

Shoes and overshoes:
1 pair high shoes
2 pair low shoes
1 pair sneakers
1 pair rubbers

Sundries:
1 umbrella
handkerchiefs
ties
collars
aprons

Economy in Shopping

Skill in buying and making clothing may make the budget allowance "go farther." This involves knowledge of fabrics, accuracy in calculating the amount of material required and the value of the labor involved in making garments. It also involves knowing when and where to buy in order to take advantage of discounts and reductions in prices.

EXERCISE II

1. What is the actual saving if a gross of pearl buttons are bought at $1.35 per gross instead of by the dozen at 12 cents a dozen? What is the per cent. of saving?

2. What is the per cent. of saving in buying handkerchiefs 2 for 25 cents over buying them at 15 cents apiece?

3. What is the actual saving in buying 12 yards of lace by the piece at $2.16 over buying the same amount by the yard at 20 cents a yard? What is the per cent. of saving?

4. If underwear muslin costs 30 cents per yard or $3.45 per 12-yd. piece, what is the per cent. of saving in buying it by the piece?

5. Some merchants offer 6 per cent. discount on muslin sold by the piece instead of by the yard. What would be the actual saving on a 12-yard piece if the muslin were 35 cents a yard? What would be the resulting price per yard?

6. In buying plaid for a kilted skirt, Mary bought 4 yards when $3\frac{1}{2}$ would have been enough. If the extra $\frac{1}{2}$ yard could not be used, what was the per cent. of increase in the cost of the material due to inaccurate estimating?

7. Estimate the cost of inaccuracy if 10 yards of taffeta silk at $1.75 per yard were purchased for a dress that required only 7½ yards.

8. Through carelessness in measuring the windows, Mrs. Rafferty lacked 10 inches of having enough material for the fourth window of the dining-room, and had to buy 2½ yards more net at 37 cents a yard. Find the cost of her carelessness.

Home Dress-Making

There are advantages in making some of the clothing at home if either the home-maker or her daughter has the time necessary for the work. First of all, there is the advantage of knowing from experience that labor is an important item in the cost of clothing. Then home-made garments usually last longer because a better grade of material is purchased than is used for similar garments in the factory. There is also a small saving of money in that the actual outlay covers only the cost of material exclusive of labor. Moreover, the girl or woman who learns to make her own clothes gains skill that may be used in altering ready-made clothes and in renovating and remodeling partly worn garments as occasion may demand.

EXERCISE III

In making estimates use the following data:

(*a*) A kimono nightgown requires 3½ yards of material, 2½ yards of trimming, and ½ spool of thread.

(*b*) A petticoat requires 3½ yards of material, 3 yards of lace or embroidery, ½ spool of thread, and 5½ yards of bias tape.

(*c*) A combination corset cover and drawers requires 2⅓ yards of material, 6 yards of lace, 1 yard of beading, and ½ spool of thread.

1. Estimate the cost of a nightgown if longcloth at 35 cents a yard is used, lace at 12 cents a yard, and thread at 6 cents a spool.

2. Estimate the cost of a petticoat and combination suit if longcloth at 30 cents a yard is used, lace at 18 cents a yard, thread at 6 cents a spool, beading at 12 cents a yard, and bias tape at 15 cents for a 12-yard piece.

3. Estimate the cost of the materials for the following underwear: 3 nightgowns, 2 petticoats, and 4 combination suits, if cambric at 32 cents a yard is used, lace at 10 cents a yard, bias tape at 14 cents per 12-yard piece, beading at 8 cents a yard, and thread at 6 cents a spool.

4. Ready-made garments, similar to the above but of somewhat inferior quality, may be purchased for the following prices: Nightgowns at $1.75 apiece, combination suits at $2 apiece, petticoats at $2.25 apiece. Find the total cost of the ready-made garments. How much is saved by making the garments at home as in problem 3?

5. If it takes 4 hours to make a combination suit, 1½ hours to make a nightgown, and 6 hours to make a petticoat, what is the total amount of time consumed in making the complete set of underwear? If the difference in cost between the ready-made and home-made garments represents the value of the home work, how much is earned per hour?

6. Jane Stewart needs the following underwear: 2 nightgowns, 3 combination suits, and 1 petticoat. She can buy them at the following prices: Nightgowns at $2 apiece, combination suits at $2.25 apiece, and petticoats at $2.50 apiece. Or she can purchase materials at the following prices: Cambric at 35 cents per yard, embroidery at 10 cents per yard, bias tape at 15 cents per 12-yard piece, beading at 10 cents per yard, and thread at 6 cents a spool. Compare the cost of the ready-made and home-made underwear. How much time will it take to make the underwear at home? How much does Jane earn per hour for her work?

7. Mrs. Jones can buy a georgette crepe waist for $10, or the materials to make it for $8.30. It will take her 17 hours to make the waist. Is it more profitable to make the waist or buy it? Could she afford to have the waist made?

8. Mrs. Potter, a young wife, found that she could not buy a spring suit for less than $30. So she decided to buy the following material and make it herself.

4½ yds. of shepherds-plaid suiting at $1.50 per yd.
1½ yds. of sateen at 20 cents a yd.
8 buttons at 75 cents a dozen
8 yds. of ¼-inch silk braid at 10 cents per yd.
¾ yd. of belting at 15 cents per yd.
2 spools of silk at 10 cents per spool
1 pattern at 20 cents
1 piece of seam binding purchased at a sale for 10 cents.

What did her suit cost her, not counting her labor? What did she save by making it herself?

Garment	Kind of Material	Am't required for 1 garment	Price
Serge dress	Serge	3½ yards	$2.25 per yard.
	Braid	4½ yards	.08 per yard.
	Sateen	½ yard	.50 per yard.
	Seam-binding	4 yards	.15 per 10 yards.
	Thread	1 spool	.15.
	Belt	1	1.00.
	Snaps	8	.10 per dozen.
	Messaline tie	1	.75.
Wool skirt	Serge	2 yards	2.40 per yard.
	Belting	27 inches	.25 per yard.
	Sewing silk	⅛ spool	.15 per spool.
	Thread	⅛ spool	.08 per spool.
	Hooks and eyes	3	.15 per card of 24.
	Snaps	4	.10 per dozen.
White cotton skirt	White rep	3 yards	.60 per yard.
	Buttons	4	1.00 per dozen.
	Hooks	6	.10 per dozen.
	Snaps	6	.15 per card of 24.
	Thread	⅜ spool	.08 per spool.
	Tape	1 piece	.10 per piece.
	Belting	26 inches	.25 per yard.
3 middy blouses	White rep	2½ yards	.50 per yard.
	Buttons	4	1.00 per dozen.
	Thread	½ spool	.08 per spool.
Gingham dress	Gingham	7⅔ yards	.35 per yard.
	Flaxon	½ yard	.60 per yard.
	Rep (for extra collars, cuffs)	⅜ yards	.50 per yard.
	Hooks and eyes	½ card	.15 per card.
	Thread	1 spool	.08 per spool.
2 petticoats	No. 100 cambric	2½ yards	.50 per yard.
	Cross-bar dimity	1 yard	.35 per yard.
	Lace	2 yards	.10 per yard.
	Buttons	3	.15 per dozen.
	Thread	1 spool	.08 per spool.
	Bias tape	5½ yards	.15 per 12 yards.
Dark underskirt	Black sateen	2¾ yards	.60 per yard.
	Button	1	.15 per dozen.
	Thread	½ spool	.08 per spool.
	Snaps	2	.12 per dozen.
4 combination suits	Cambric	2¼ yards	.35 per yard.
	Lace	4 yards	.10 per yard.
	Beading	1½ yards	.10 per yard.
	Thread	1 spool	.08 per spool.
	Buttons	3	.15 per dozen.
Bloomers	Sateen	2¼ yards	.50 per yard.
	Elastic	1 yard	.12 per yard.
	Buttons	2	.15 per dozen.
	Thread	½ spool	.08 per spool.
3 nightgowns	Cambric	2½ yards	.35 per yard.
	Lace	2 yards	.10 per yard.
	Thread	1 spool	.08 per spool.

9. Mary Thompson makes her own underwear of cotton crepe instead of longcloth so that she can wash it herself as the crepe does not need to be ironed. What is the cost of 4 combination suits and 2 nightgowns if the underwear crepe is 32 cents a yard; lace is 16 cents a yard; beading, 15 cents a yard; and thread, 6 cents a spool? What does she save in laundry bills in a year if she wears 2 suits and 1 nightgown a week and the cost of laundering is 10 cents apiece for combination suits and 12 cents for nightgowns?

10. Elizabeth Marshall, a high school girl, decided to make her own clothes. From the list on page 95 of the garments that she selected and the quantity and the price of materials used, find the total cost of her clothing exclusive of the cost of the labor.

11. Elizabeth wished to know how much she had saved by her sewing but found that she could not get ready-made garments of as good quality of material as that she had used. The prices of the garments she selected for the purpose of comparison were as follows: Nightgown, $1.75; serge dress, $18; blue wool skirt, $8; white cotton skirt, $3; gingham dress, $3.50; white petticoat, $4; dark underskirt, $1.50; combination suit, $2.25; bloomers, $1.50; blouse, $1.50. How much did she save?

12. Estimate the cost of materials for replacing your present supply of underwear if the new garments are made at home.

13. How much would you have to pay for ready-made underwear to replace your present supply?

14. Estimate the number of hours it would take you to make your underwear and find the value of your labor at the local prices paid for sewing.

Amount of Material for Garments

In estimating the amount of material needed for straight skirts (Fig. 14) and similar garments, such as petticoats, nightgowns, aprons, and plain chemises, state the results to the nearest one-eighth or one-fourth yard, since these are the measures used in the stores.

Rule.—(*a*) To find the number of lengths needed for straight skirts divide the total breadth of the bottom of the skirt by the width of the material. Consider a fractional part of a length as a whole length unless it is possible to secure the desired effect by omitting the fractional part of the length.

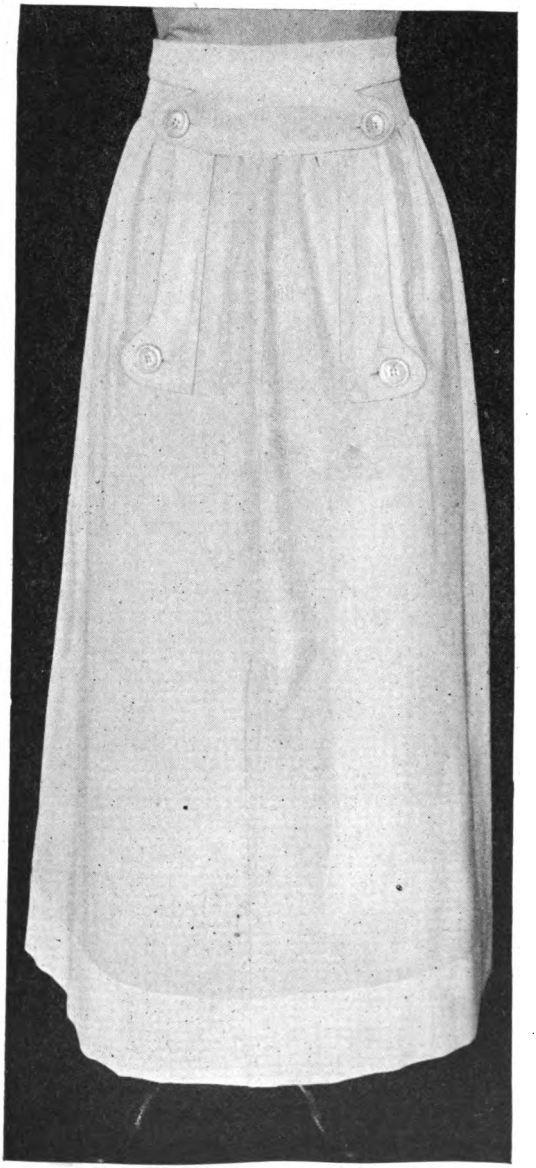


FIG. 14.—Straight skirt.

(*b*) To allow for hems, add the width of the hem to the finished length.

(*c*) To find the amount of material needed, multiply the total length by the number of lengths.

EXERCISE IV

Problem.—How much lawn, ¾ yard wide, will be needed for a plain petticoat 24 inches long which measures 3 yards around the bottom and is finished with a 2½-inch hem?

3 ÷ ¾ = 4, that is, the number of lengths required is 4.
21 in. + 2½ in. = 26½ in., or approximately ¾ yd., the total length.
4 × ¾ yd. = 3 yd., that is, 3 yards of lawn will be needed for the petticoat.

1. How many yards of 30-inch muslin are needed for a straight skirt 22 inches long, 1½ yards around the bottom, and finished with a 3-inch hem?

2. How many yards of muslin 1 yard wide are needed for 6 petticoats, each 16 inches long, 1½ yards around the bottom, and finished with a 2-inch hem?

3. How many yards of muslin 30 inches wide are needed for 6 straight petticoats, each 25 inches long, 2½ yards around the bottom, and finished with a 2½-inch hem?

4. A kilted skirt 24 inches long is to measure 4 yards around the bottom. How many yards of 42-inch serge are required? Allow 3½ inches for a hem.

5. A dancing frock is to have a plaited skirt 5 yards around the bottom. How many yards of crêpe de Chine 44 inches wide are required? Allow 3 inches for a hem.

6. How much longcloth, one yard wide, is needed for a kimono nightgown 54 inches long, 2 yards around the bottom, and finished with a 2-inch hem?

7. How much cotton crepe, 30 inches wide, is needed for a nightgown 47 inches long, 2½ yards around the bottom, and finished with a 2-inch hem, if it has set-in sleeves 12 inches long, finished with a ¾-inch hem? (One length will be needed for each sleeve.)

WAISTS

RULE.—(*a*) To find the amount of narrow material needed for shirtwaists, add the length of the sleeve without the cuff, length of the back, including the peplum, and twice the total length of

the front, including the amount allowed for the peplum (*i.e.*, the part of the waist below the belt line).

(*b*) To find the amount needed when the material is 34 to 36 inches wide, add the length of the back, including the peplum, twice the total length of the front, and ⅔ the sleeve length without the cuff (Figs. 15 and 16).

EXERCISE V

1. How much madras 27 inches wide is required for a plain shirtwaist that extends 3 inches below the belt line? The length of the back is 15 inches to the belt, the length of the front is 16 inches, the length of the sleeve is 18 inches (Rule a).

2. How much percale one yard wide is required for this waist, if rule b is used?

3. What is the difference between the two estimates?

4. How much linen 30 inches wide is needed for a plain shirtwaist with a 3-inch peplum? The length of the front is 20 inches, of the back 16 inches, of the sleeve 22 inches. (Rule a.)

5. How much georgette crepe 36 inches wide is required for a plain waist with a ½-inch hem at the belt for elastic belting? The front of the waist measures 15 inches, the back 14 inches, and the sleeve 18 inches. (Rule b.)

6. A wide sailor collar that takes an extra ½ yard of the material is used for trimming this waist. If the georgette crepe costs $2.25 a yard, what is the cost of material for the blouse?

7. A saleswoman told a customer that the average person would need 2½ yards of linen for a shirtwaist. The customer was a woman with a 36-inch bust measure. If the front of the waist is 17 inches long and has a 3-inch peplum, the back 15, and the sleeve 22 inches, how much more will she have than is necessary? If the linen cost $1.50 a yard, how much can she save by making her own estimate?

8. A shirtwaist is to be made of white voile 1 yard wide at 85 cents a yard. How much material is required if the front measures 16 inches, the back 15 inches, and the sleeve without the cuff 18 inches, and the waist is finished at the belt with a ½-inch hem for an elastic. What is the cost of the material?

9. How much gingham 1 yard wide is required for a plain straight skirt and shirtwaist? The skirt is to be 26 inches long. It measures 2 yards around the bottom and is finished with a 3½-inch

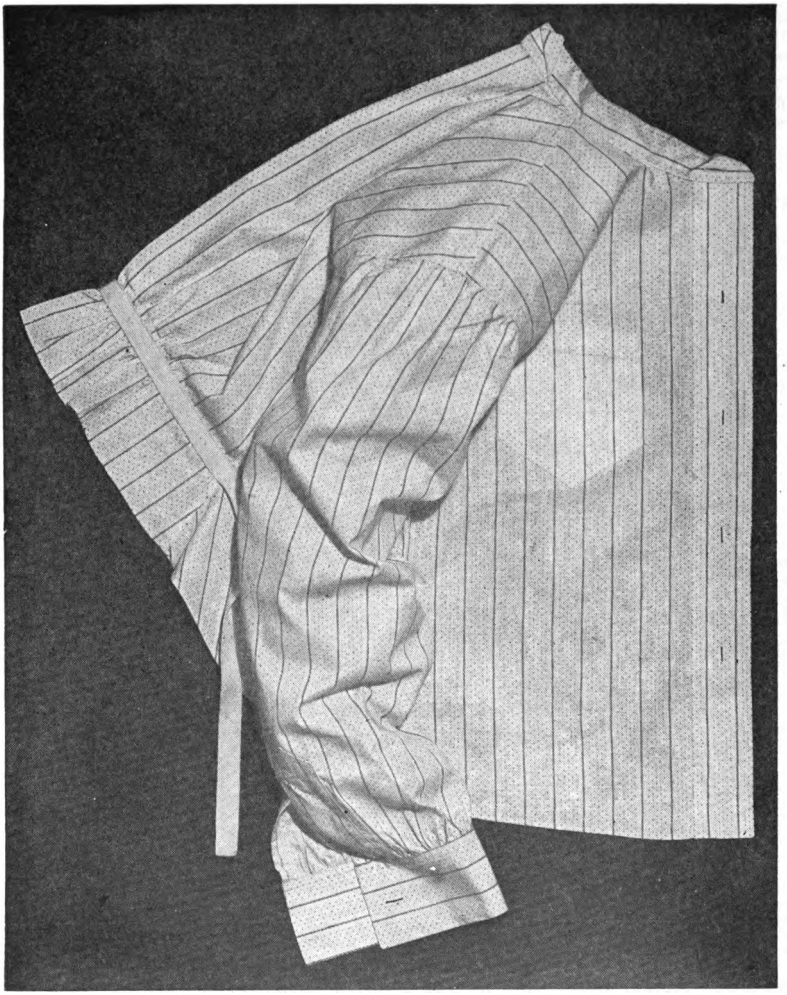


FIG. 15.—Waist.

hem. The front of the waist measures 16 inches, the back 15, the sleeve without the cuff 18 inches. There is no peplum. If gingham cost 75 cents a yard, find the cost of the material.

10. How much batiste 1 yard wide is required for a commence-

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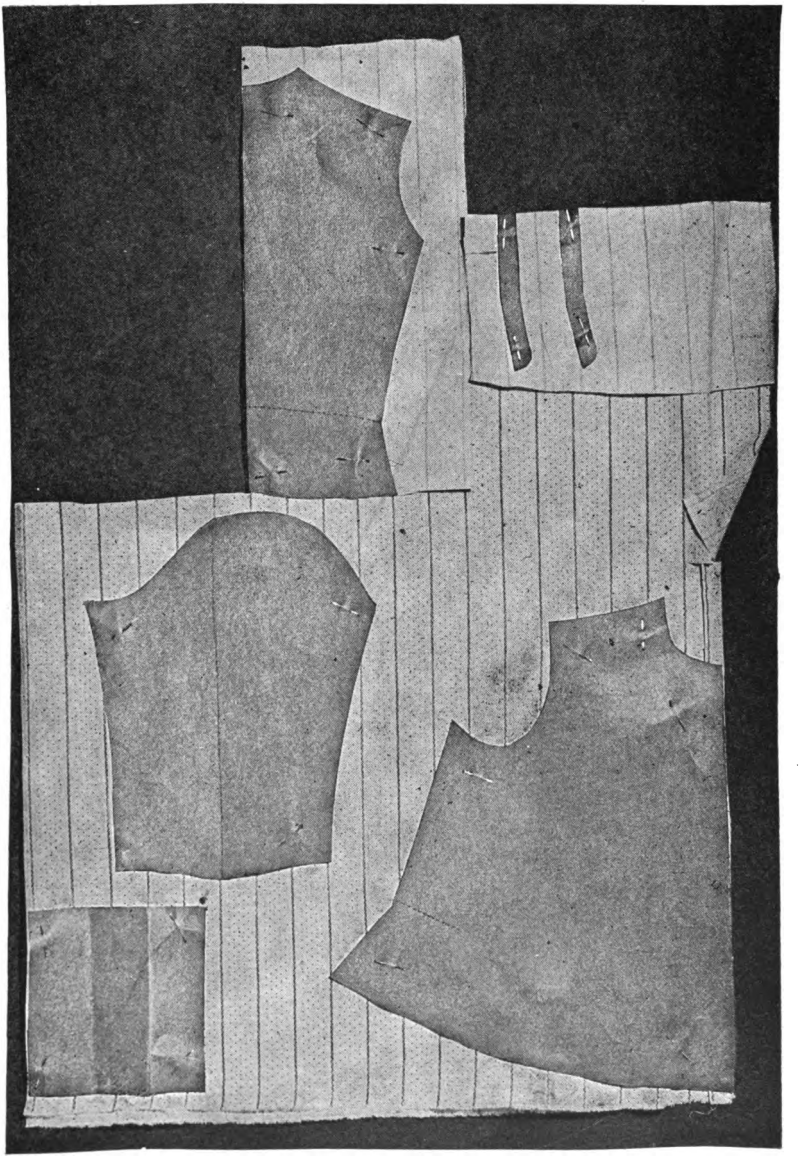

FIG. 16.—Waist pattern on cloth.

ment dress? The skirt length is 34 inches. It is to be finished with a hem 5½ inches wide. The front of the waist is 17 inches long, the back 15, and the sleeves, which are short, are to be 14 inches long. Three yards of lace are required for the trimming and 1½ yards of ribbon. Find the cost of the dress, if the batiste costs 90 cents a yard, the lace 38 cents a yard, and the ribbon 64 cents a yard.

11. Make a rule for estimating the amount of material required for a middy blouse.

12. Estimate the cost of the material for a middy blouse for yourself.

13. If it takes 8 hours to make a middy blouse, estimate the cost of the material and the cost of the labor for making, and compare the total estimate with the cost of a ready-made middy blouse of approximately the same quality.

14. Estimate the amount of material required for a plain tailored shirtwaist for yourself. If it requires 8 hours to make the waist, find the value of the labor at 42 cents an hour, or at the current local rate. Find the total cost of the waist including both labor and materials.

Trimming for Garments

Tucks (Fig. 17), cords, folds, bias bands, and ruffles are used in trimming garments. Such trimming usually increases the amount of material required for plain garments.

TUCKS

Rule.—(*a*) Twice the width of each tuck multiplied by the number of tucks gives the allowance to be made for tucks.

(*b*) Twice the width of the receiving tuck plus ¼ inch for the first turning gives the allowance for a receiving tuck (Fig. 18).

EXERCISE VI

Find how much must be allowed for the following tucks in one length of material:

1. 3 half-inch tucks.
2. 5 quarter-inch tucks.
3. 10 sixteenth-inch tucks.

4. 5 three-eighth-inch tucks.
5. 20 sixteenth-inch tucks.
6. 3 one-and-a-half-inch tucks.
7. 24 three-eighth-inch tucks.
8. 1 three-eighth-inch receiving tuck.
9. 1 one-quarter-inch receiving tuck.

Estimate the amount to be added to each length of the following garments to allow for the tucks and hems:

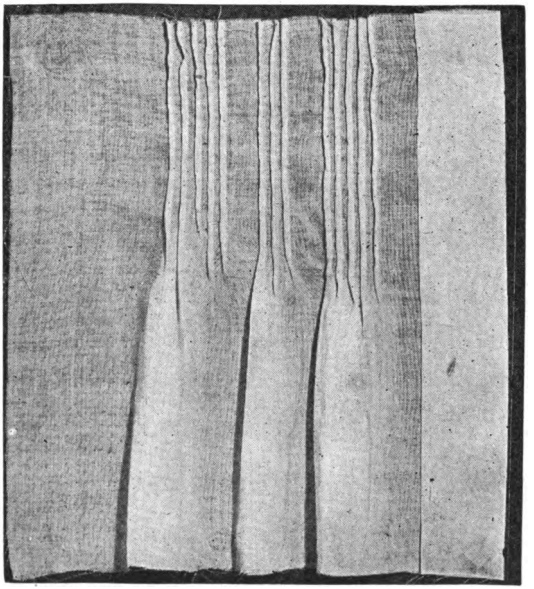

FIG. 17.—Fine hand-run tucks.

10. A skirt with 5 sixteenth-inch tucks and a 3-inch hem.
11. Two sleeves with 10 quarter-inch tucks.
12. A petticoat with 9 eighth-inch tucks and a one quarter-inch receiving tuck.
13. How many quarter-inch tucks are needed to shorten a garment 7 inches?
14. How many half-inch tucks are needed to shorten a garment 5 inches?

EXERCISE VII

1. The back of a blouse was 16 inches across when finished. It had 3 groups of 5 sixteenth-inch tucks. How wide was the piece for the back before it was tucked?

2. How many half-inch tucks must be put in a skirt that is 5 inches too long in order to make it the right length?

3. The lawn for a shirtwaist is 27 inches wide. How many eighth-inch tucks can be made in the lawn if it is to be 20 inches wide when finished?

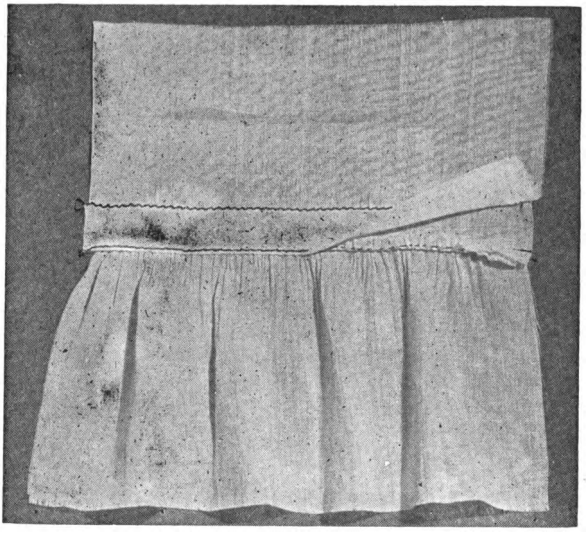

FIG. 18.—Receiving tuck.

4. Jane wishes to put 5 one-inch tucks in a skirt which is to be 38 inches long. How long must the skirt be cut to allow for the tucks and a 3-inch hem?

5. A piece of muslin for the back of a corset cover is 26 inches wide. How many quarter-inch tucks can be made in order that the back may be 16 inches wide when finished?

6. A strip of muslin for a ruffle is 12 inches deep. The ruffle is to have a one-inch hem and 7 eighth-inch tucks. How deep will it be when finished? If this ruffle is attached to a petticoat with a

⅜-inch receiving tuck, how long should the petticoat be cut in order that the completed garment may be 35 inches in length?

7. How deep must a ruffle be cut to be 6 inches deep finished with a one-inch hem on the bottom and 5 eighth-inch tucks above the hem? If the completed petticoat is to be 29 inches in length, how long must it be cut to allow for attaching the ruffle with a ¼-inch receiving tuck?

8. How deep a ruffle can be made from a strip of lawn 20 inches deep, if a 2-inch hem is put on the bottom and above it 5 groups of 3 sixteenth-inch tucks?

RUFFLES

RULE.—To find the number of strips of material needed for a ruffle divide the length of the ruffle by the width of the material. Consider a fraction of a strip as a whole strip, unless it is possible to secure the desired effect by omitting the fractional part of a strip.

To find the amount of material needed, multiply the depth of the ruffle by the number of strips.

EXERCISE VIII

Problem.—A ruffle 6½ yards long and 5 inches deep is finished with a half-inch hem. How many strips of 27-inch material are needed for the ruffle? How many yards of material are needed?

27 in. = ¾ yd.
6½ yd. ÷ ¾ yd. = 8 +, that is, 9 strips are needed.
5 in. + ½ in. = 5½ inches, the depth of the ruffle.
9 × 5½ in. = 49 + inches, that is, approximately 1⅜ yds. of material are needed.

1. How many strips of muslin one yard wide are needed for a ruffle six yards long? If the ruffle is 9 inches deep, unfinished, how many yards of material are needed?

2. Of material 27 inches wide?

3. Of material 44 inches wide?

4. Of material 32 inches wide?

5. How many strips of cambric one yard wide are needed for a ruffle 4½ yards long? If the ruffle is 8 inches deep, unfinished, how many yards of material are needed?

6. Of cambric 27 inches wide?

7. Of material 45 inches wide?

8. Of material 34 inches wide?

9. Of cambric 30 inches wide?

10. How many yards of dimity 32 inches wide are needed for a ruffle 12 inches deep, unfinished, if the ruffle is 3¾ yards long?

11. Of taffeta 40 inches wide?

12. A ruffle 5 inches deep is finished with a one-inch hem and 3 eighth-inch tucks. If the ruffle is 5 yards in length, how many yards of 27-inch material are needed?

13. A ruffle 4½ inches deep is finished with a half-inch hem and 5 eighth-inch tucks. If the ruffle is 6 yards in length, how many yards of 45-inch nainsook are needed?

14. If the material is one yard wide, how many yards of ruffling can be made from 6 strips?

15. If the material is 27 inches wide?

16. If the material is 42 inches wide?

17. If the material is 30 inches wide?

18. How many strips of ruffling 9 inches deep can be cut from 4 yards of lawn? How many yards of ruffling if the lawn is 27 inches wide?

19. How many yards of ruffling 4 inches deep can be cut from 1½ yards of 27-inch satin?

20. How many yards of ruffling 12 inches deep can be cut from 2½ yards of 32-inch taffeta?

EXERCISE IX

RULE.—(*a*) For an ordinary ruffle, use 1½ the length of the edge to which the ruffle is to be attached.

(*b*) For a scant ruffle, use 1⅓ this length.

(*c*) For side plaiting or for shirring of thin fine fabrics, use three times this length.

Unless otherwise stated, it is understood that the ruffling in the following example is to be set on the bottom edge of the skirt.

1. How many yards of ruffling are needed for a ruffle on a skirt which measures 3 yards around the bottom? 2½ yards? 2¾ yards?

2. How many yards of lace are needed for a ruffle on a collar which measures 1⅛ yards around the edge? ⅝ yard? ¾ yard?

3. How many yards of bias ruffling are needed for a scant ruffle on a silk petticoat which measures 2 yards around the bottom? 2¼ yards?

4. How many yards of taffeta ruffling are needed for side

plaiting for trimming the edge of a collar that measures 1½ yards, the edge of cuffs each 8 inches, and both sides of the front plait of the waist which is 16 inches long?

5. A skirt is 3 yards around the bottom; how many yards of ruffling are needed? How many strips of one-yard material are needed?

6. How many yards of ruffling are needed for a ruffle on a dress 2 yards around the bottom? If the ruffle is to be 6 inches wide finished, how much batiste 45 inches wide is needed for the ruffle?

7. A taffeta skirt measures 2¼ yards around the bottom. How many yards of ruffling are needed? If the ruffle is 10 inches deep unfinished and is cut from material 32 inches wide, how many yards of material are needed for the ruffle?

8. A skirt is 2½ yards around the bottom. How many yards of ruffling are needed? If the ruffle is 8 inches deep finished with three quarter-inch tucks, and the cambric is 1 yard wide, how many yards of material are needed for the ruffle?

9. A petticoat measures 3 yards around the bottom. How many yards of 30-inch cambric are needed for a 10-inch ruffle having a one-inch hem?

10. How many yards of 40-inch silk are needed for a 12-inch, scant ruffle for a petticoat which is 2½ yards around the bottom, if the ruffle has a one-inch hem?

11. A child's dress is 2 yards around the bottom. How much lawn 1 yard wide is required for a full-shirred ruffle 7½ inches deep finished with a half-inch hem and 3 eighth-inch tucks?

12. How many trips of ruffling will be needed for a muslin skirt 2½ yards wide if the material is 1 yard wide? How wide must the ruffle be cut if it is 10 inches deep, finished with a half-inch hem and two quarter-inch tucks? How many yards of material will be needed?

13. If a dress measures 3 yards around the bottom, how many yards of ruffling are needed for side plaiting? How many strips of 45-inch batiste? If each strip is 10 inches finished, has a three-quarter-inch hem, and four eighth-inch tucks, how many yards of batiste are needed?

14. A dress measures 2 yards around the bottom. It is to have a side-plaited ruffle 10 inches wide with a one-inch hem. How many yards of crêpe de Chine 40 inches wide are necessary for the ruffle?

15. Estimate the number of yards of dotted swiss, 32 inches wide, needed for 4 curtains each 4 feet 6 inches long, trimmed along one side and across the bottom with a 3-inch ruffle finished with a ¼-inch hem and set on with a ⅜-inch receiving tuck. Allow 3 inches at the top of each curtain for the rod and the heading and 3 inches for shrinking.

16. Estimate the cost of curtains similar to the above for your own bedroom.

BIAS TRIMMING

Material to be used for trimming a garment is often cut on the bias. Unless one can purchase material in which both ends are

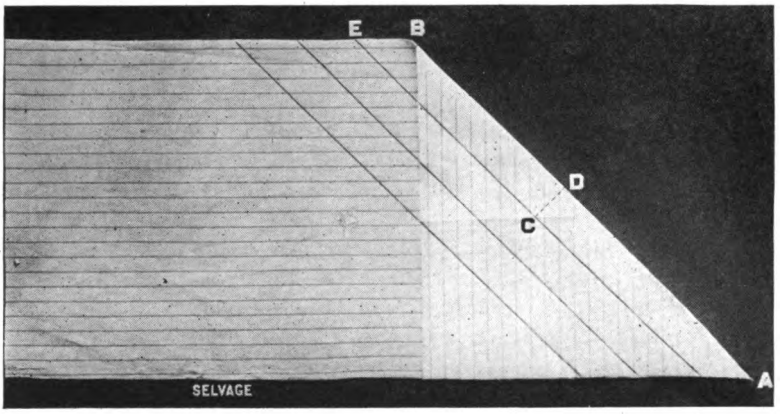

FIG. 19.—True bias cutting.

cut on the bias, there will be more or less waste in cutting. In order to have as little waste as possible, one should know how to estimate the amount of material required for trimming any given garment.

To cut a strip of true bias (Fig. 19), fold the material so that the filling yarns [2] lie along the warp, as in the diagram. Make two cuttings, the first along the line of the fold *AB*, and the second on a line parallel to the line of the fold.

The lines of cutting are bias lines. A full length bias strip

[2] Threads that run parallel to the selvage are called warp threads, those that run across the goods are called filling yarns or woof threads.

is a strip with selvage at both ends. The length of a full-length bias strip is measured along the cut edge from *A* to *B*.

The width through the bias strip is measured on a line at right angles to the line of cutting, *CD* in the diagram.

The width along the bias is measured along the selvage (or warp), *BE* in the diagram.

The width through the bias and the width along the bias are technical terms used in the trade. The width through the bias is also called the depth of the bias.

EXERCISE X

1. From a rectangular piece of tissue paper or cloth 24 inches long and 9 inches wide cut out as many full-length strips of true bias 3 inches through the bias as possible.[3]

2. Measure the length of the bias. How does it compare with the original width of the cloth or paper?

3. What is the width of each strip along the bias?

4. How does the width along the bias compare with the width through the bias? (Give the answer as approximate fraction of the width through the bias.)

5. Make the same measurements as in examples 1–4 with a piece of paper 18 inches wide and 24 inches long, cutting strips 1 inch through the bias.

6. From your answers to 5, what rule would you suggest for finding the length of a full-length bias strip if the width of the material is known?

7. From your answers to 4, what rule would you suggest for finding the width along the bias?

8. Dressmakers multiply the width of the material by $1\frac{1}{3}$ to find the length of a bias strip. Test this rule.

9. To find the width along the bias, dressmakers multiply the width through the bias by $1\frac{1}{3}$. Test this rule.

EXERCISE XI

In cutting bias strips, as in Fig. 20, if the corner folded over, *AC*, is less than the full width of the goods, the bias strip will be less than a full-length strip. The length of a short strip is measured

[3] If paper is used, it should be handled and held as if it were cloth.

along the shorter cut edge *BC*. Where two bias strips are to be pieced together, all the seams should be along the warp, *CD, EF, GH,* etc. The pieces *CDE, EFG, GHJ,* which are cut off in order to have the seams along the warp, are waste.

1. Using a piece of tissue paper 24 inches long and 18 inches

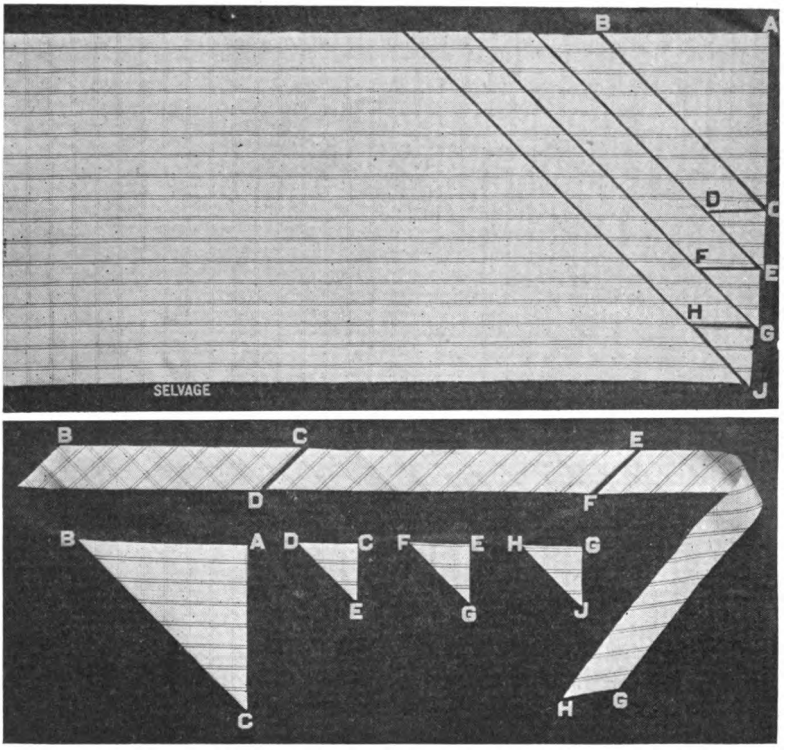

FIG. 20.—Cutting and joining bias strips.

wide, fold over a corner 9 inches on each side and cut along the fold (Fig. 20). Compare the length of the cut edge with the side of the corner.

2. From the corner piece cut off a bias strip 3 inches through the bias, and measure the lengths of the two cut edges.

3. Cut a piece from one end of the strip to make the two ends

parallel. By how much have you shortened the longer cut edge? Compare this amount with the width through the bias.

4. Using a rectangular piece of tissue paper 24 inches long and 18 inches wide, fold over a corner 6 inches on each side, and cut a bias strip 2 inches through the bias. Measure the shorter cut edge and compare this length with the side of the corner folded over.

5. From the corner piece, cut off another strip of the same width. Measure the shorter and the longer cut edges. How does the short length compare with the length of the side of the remaining corner? How does the difference between the lengths of the two cut edges compare with the width through the bias?

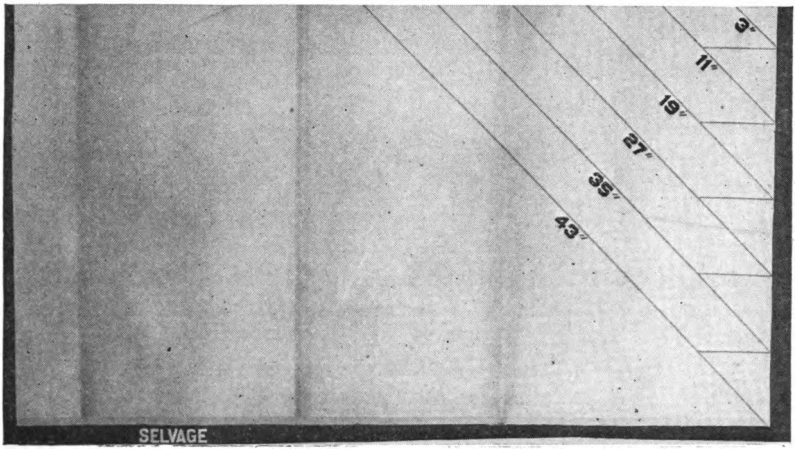

FIG. 21.—Cutting bias strips from a corner of the material.

6. Test the following rule by cutting and measuring tissue paper: The length of a bias strip is four-thirds the length of the side of the corner folded over.

7. Test the following rule by cutting and measuring tissue paper: The length of each bias strip cut from the corner is less than the next longer strip by twice the width of the strip through the bias.

EXERCISE XII

RULE.—(*a*) The length of a full-length bias strip is approximately $1\frac{1}{3}$ times the width of material. (*b*) The length of a short bias strip is approximately $1\frac{1}{3}$ times the side of the corner folded

over. (*c*) When the ends are not parallel, the length of the shorter cut edge of the bias strip cut from the corner is less than the longer cut edge by twice the width through the bias. Hence, the length of a bias strip not a full-length strip is less than the next longer strip by twice the width of the strip through the bias.

Problem.—**How many inches of 4-inch bias can be cut from the corner of a piece of silk 32 inches wide? (Fig. 21.)**

$\frac{4}{3} \times 32$ inches $= 43$ inches, the length of the full length bias strip.
No full length strip can be cut from the corner, but according to rule (c), the longest strip that can be cut from the corner is less than the full length strip by twice the width of the strip through the bias.
Hence, 43 in. — 8 in. = 35 inches, the length of the longest strip cut from the corner.
35 in. — 8 in. = 27 inches, the length of the second strip.
27 in. — 8 in. = 19 inches, the length of the third strip.
19 in. — 8 in. = 11 inches, the length of the fourth strip.
11 in. — 8 in. = 3 inches, the length of the fifth strip.
Adding, 95 inches is the total number of inches of 4-inch bias that can be cut from the corner.

1. Using the rule *a,* make a table showing to the nearest $\frac{1}{4}$ inch the length of a full strip of bias cut from material of the following widths: 18, 22, 24, 27, 30, 32, 34, 36, 39, 40, 42, 45.

When the length of the material is less than the width, the length of the material determines the size of the corner to be folded over, and hence the length of the longest bias strip. Thus, with $\frac{1}{4}$ yard of velvet 18 inches wide, the corner folded over is 9 inches along the side, and the length of a bias strip $\frac{4}{3} \times 9$ or 12 inches.

2. Make a table similar to that in example 1, showing the length of the longest bias strip that can be cut from the following:

$\frac{1}{4}$ yard of velvet 22 inches wide.
$\frac{3}{8}$ yard of grosgrain silk 22 inches wide.
$\frac{1}{2}$ yard of grosgrain silk 22 inches wide.
$\frac{5}{8}$ yard of satin 27 inches wide.
$\frac{7}{8}$ yard of taffeta 40 inches wide.

3. How many inches of 6-inch bias can be cut from the corner of a piece of silk 27 inches wide? 36 inches wide? 40 inches wide?

4. How many inches of 10-inch bias can be cut from the corner of a piece of silk 30 inches wide? 38 inches wide? 50 inches wide?

5. How many yards of bias strips 3 inches through the bias can be cut from the corner of a piece of taffeta 30 inches wide?

6. How many inches of bias strips 6 inches wide can be cut from a corner 27 inches along the side?

7. In planning a dress, Jane finds that she can use one corner piece of silk 15 inches along the selvage for bias banding. How much bias banding 2 inches wide can she cut?

8. Beginning with the first strip 5 inches long cut from the corner of a piece of silk 36 inches wide, how many strips $2\frac{1}{2}$ inches

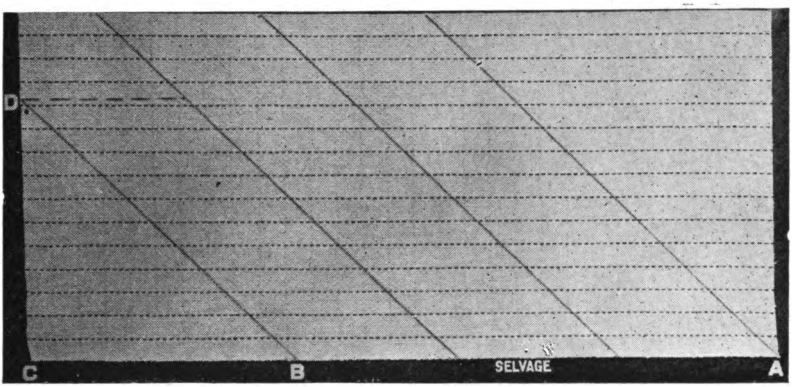

FIG. 22.—Amount of material required for bias strips.

through the bias need to be cut to obtain $2\frac{3}{4}$ yards of piping? Will the last strip that is cut be as long as a full-length bias strip?

EXERCISE XIII

RULE.—The width along the bias of a strip is four-thirds of the width through the bias.

Make a table showing the widths along the bias of bias strips whose widths through the bias measured in inches are as follows: $\frac{3}{4}$, $\frac{7}{8}$, 1, $1\frac{1}{4}$, $1\frac{3}{8}$, $1\frac{1}{2}$, $1\frac{3}{4}$, $1\frac{7}{8}$, 2, $2\frac{1}{2}$, 3, 4, 5, 6, 7, 8, to 12 inches.

EXERCISE XIV

In buying material in which the ends are not cut on the bias, it is always necessary to buy a corner of material in addition to the amount of material needed for the bias strips.

In the diagram (Fig. 22) the amount of material required would

be equal to *AB*, the width along the bias of the total number of strips, plus *BC*, the side of the corner cut off by the last strip.

Problem.—Find the number of yards of 18-inch panne velvet required for 3¼ yards of bias bands 9 inches wide (Fig. 23).

⅝ × 18 in. = 24 inches, the length of a full length strip.
24 in. — 18 in. = 6 inches, the length of a strip cut from the corner.
3¼ yd. — 6 in. = 111 inches, the number of inches remaining to be cut.
111 in. ÷ 24 in. = 4 strips and 15 inches.
Since a strip of bias 15 inches long can not be cut from the corner, 5 strips of bias must be cut, the last of which will need to be only 15 inches long.
15 inches is the bias edge of the corner folded over to make a strip of that length. (See diagram.)
Hence, ¾ of 15 or 11 is the width of the corner folded over to make the last strip.
It is necessary to buy a piece of velvet 11 inches long plus the total width along the bias of the 5 strips.
5 × ⅛ × 9 in. = 60 in., the total width along the bias of the 5 strips.
60 in. + 11 in. = 71 in., that is, 2 yards of velvet are required.

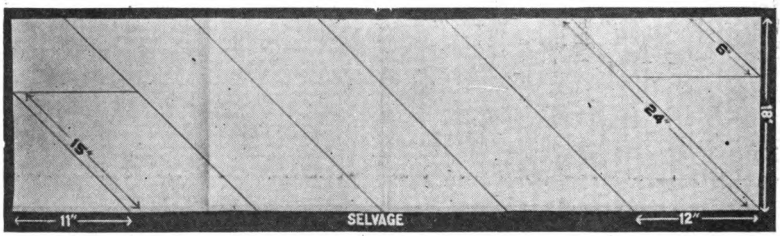

FIG. 23.—Estimating the amount of material required for bias trimming when part or all of corner can be utilized.

1. Find the number of yards of 18-inch panne velvet required for bias girdle 9 inches wide and 30 inches long?

2. A girdle is to be made from bias strips cut from 22-inch silk. If the girdle is to be 28 inches long and 12 inches wide, before finishing, how much material is required?

3. Find the amount of 18-inch velvet required for 4 yards of bias facing for a coat, if the facing is 10 inches through the bias.

4. Three yards of bias 12 inches wide are needed for a ruffle on a petticoat. How much taffeta 36 inches wide is required for the ruffle?

5. Seven yards of satin facing 6 inches wide are needed for the bottom of a skirt and the overskirt. How many yards of 27-inch satin are required for the facing?

6. If two scant bias ruffles each 4 inches wide are put on the bottom of a partly worn petticoat that measures two yards around the bottom, it will take the place of a new skirt. How many yards of 30-inch taffeta are needed?

7. How much 27-inch taffeta must be purchased for a new scant ruffle on a petticoat which measures 2 yards around the bottom, if the ruffle is to be 10 inches wide?

Buying and Making Clothes

The cost of clothing is so large an item in the budget that every effort should be made to decrease the expenditures and to spend the money for clothing to the best advantage. Extreme styles that go out of fashion before the material is worn out increase the cost of living. Poor materials are not worth the cost of the time and labor it takes to make them up into garments.

In buying materials and ready-made clothes, it is cheaper to select durable materials and conservative styles.

EXERCISE XV

1. Select a design for a dress and estimate the number of yards of material you would need to buy, and the time it would take to make such a dress for yourself. Estimate the cost of material and the cost of labor at the local dressmaking rates. Will your labor be worth as much? Why?

2. Select a design for a dress with bias trimming. Estimate the amount and cost of suitable material for the dress and for the trimming. Find the total cost of the dress and of the labor. Compare with the cost of a similar ready-made gown and discuss differences in cost, design, material, and workmanship.

3. If all your present supply of wearing apparel should be destroyed by fire, estimate the cost of duplicating as much of it as you would need to replace, including shoes, hats, and similar articles. Make a separate estimate for each garment that would have to be made at home, giving the number of yards of material required, and the "findings."

4. Make a list of all the articles of clothing you would need for a year. Estimate the cost of the various articles and determine how much of an allowance you would need for clothing.

5. If you were to spend $150 per year, how would you modify the preceding budget? If $100?

6. Indicate which of the articles in your list do not have to be renewed every year, and make a clothing budget for 3 years. Can you reduce your annual budget allowance in this way? Why?

7. Compare the present prices of cotton and woolen materials, shoes, stockings, and notions with the prices of the same articles one year ago. Find the average per cent. of increase or decrease in the cost of these articles.

8. If this average per cent. of change in price should continue for another year, how should your budget allowance for clothing be changed?

9. Compare graphically the actual prices of cotton and woolen materials, shoes, notions, and underwear at the present time with those of one year ago. Use two vertical lines for each article, one to represent the present price, the other to represent the price one year ago.

10. Represent graphically the average per cent. of increase or decrease in the prices of clothing in the past year.

11. Two girls bought suits at the same time. One paid $20 for a suit that was so extreme in design that it was entirely out of style at the end of the season and was discarded. The other paid $32.50 for a plain tailor-made suit which she wore for three seasons. At this rate, how much more would the first girl pay for suits in three years?

12. It requires 2½ yards of muslin and 5 yards of trimming for an envelope chemise and about 4 hours for the making. Four chemises were made of muslin at 25 cents a yard and lace at 14 cents a yard. What was the cost of the chemises if the labor is estimated at 25 cents an hour?

13. At the end of a year the muslin was worn out, and the lace was not worth putting on new garments. Four new chemises were made of better materials at 37 cents a yard and lace at 14 cents a yard. These garments lasted a year and a half. What was the total cost, including labor at 25 cents an hour? What was the cost per year? What is the per cent. of decrease in this item of the clothing budget?

FOOD

FOOD

Measuring Food Materials

There are several ways of measuring and weighing foodstuffs. The housewife uses the familiar household measures (Fig. 24): The cup and the spoon; the grocer uses the English system of weights and measures: the quart and the pound; the scientific dietitian uses the metric system of weights and measures: the liter as a measure of

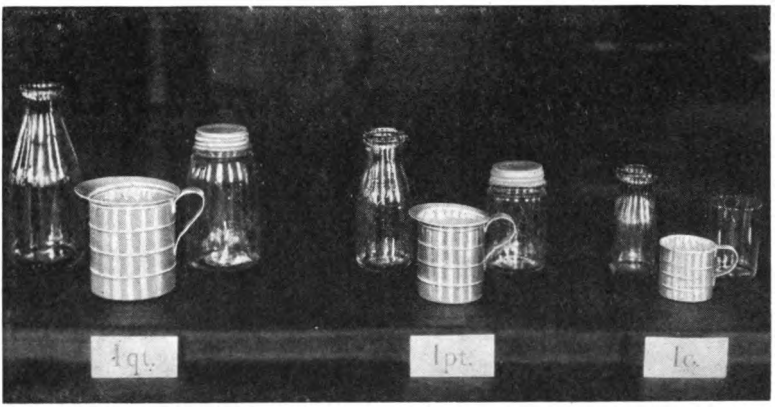

Fig. 24.—Measures commonly used in the household. Metal measures are usually the most accurate and convenient.

volume, the gram as a measure of weight and the calorie as a measure of heat or energy. Each of these ways of measuring the weight and quantity and nourishing value of foods is to be considered in the following pages.

Household Weights and Measures

Recipes are usually stated in terms of household measures such as the cup and the tablespoon. These household measures vary in size and capacity and, at best, represent only approximate measures. In order to secure some degree of uniformity, it is customary to use a level cupful, or level spoonful in measuring.

Abbreviations

ts. = teaspoon	qt. = quart
tbs. = tablespoon	pt. = pint
spk. = speck	oz. = ounce
c. = cup	lb. = pound

Table of Approximate Measures

3 teaspoons = 1 tablespoon
16 tablespoons dry material or 12 tablespoons of liquid = 1 cup
2 cups or 2 glasses = 1 pint

Tables of Equivalent Weights and Measures for Liquids

1 tablespoon = ⅔ oz.
1 cup or 1 glass = 8 ounces or ½ pound.

Table of Measures of Food Materials with Approximate Weights[1]

Foodstuff	Quantity in 1 lb.	Quantity in 1 oz.
Milk	2 c.	1½ tbs.
Sugar	2 c.	2 tbs.
Butter	2 c.	2 tbs.
Meat (chopped)	2 c.	2 tbs.
Rice	2 c.	2 tbs.
Flour (sifted)	4 c.	4 tbs.
Rolled oats	6 c.	6 tbs.
Eggs	7	
Apples	4 medium	
Bananas	4 medium	
Oranges	2 large	
Potatoes	3 medium	
Bread	1 loaf	

EXERCISE I

1. How many tbs. of dry material to 1 cup? To ⅓ cup? To ⅔ cup? To ¾ cup? To ⅛ cup? To ⅜ cup? To ⅝ cup? How many tablespoons of liquid?
2. How many ts. in ¼ cup of dry material? In ⅓ cup?
3. How many ts. of butter in 1 oz.? In ½ oz.?
4. How many ts. of flour in 1 oz.? In ½ oz.?
5. How many tbs. of butter in ⅛ lb.? In ¼ lb.?
6. How many tbs. of butter in 3 oz.? What part of a cup?
7. One-fourth pound of sugar is how many cups?
8. One-fourth pound of flour is how many cups?
9. One-eighth pound of sugar is how many tbs.?

[1] For other tables with slightly closer approximations, see Tables C and D, pages 184 and 188.

10. One-third pound of sugar is how many tbs.? And what part of a cup?

11. One egg is how many ounces?

12. How many tbs. of milk in an oz.?

13. How many tbs. of sugar in an oz.?

14. How many tbs. of flour in an oz.?

EXERCISE II

Translate into weights the following recipes:

1. White sauce: 2 tbs. flour, 2 tbs. butter, 1 cup of milk.

2. Biscuits: 2 cups flour, 1½ tbs. shortening, ¾ cup milk, 4 ts. baking powder, ½ ts. salt.

3. Croquettes: 2 cups chopped meat, 2 cups of bread crumbs, 1 cup of milk, 2 eggs.

4. Potato balls: baked potatoes, 1 tbs. butter, ⅓ cup of milk, 1 egg.

5. Fruit salad: 3 bananas, 3 oranges, 3 tbs. of olive oil, ¼ cup of sugar, 1 tbs. vinegar.

6. Cake: ¼ cup butter, 1 cup sugar, 2 eggs, ½ cup milk, 1½ cups of flour.

7. Baked apples: 6 apples, ⅔ cup sugar, ⅔ cup of water.

8. Omelet: 4 eggs, 4 tbs. milk, 2 tbs. butter.

9. Potato soup: 4 medium-sized potatoes, 3 cups milk, 1 cup water, 2 tbs. butter, 2 tbs. flour.

10. The following is a recipe for cocoa for three persons. Give the proportion for one person in the most convenient form; also for 24 persons: 1 tbs. cocoa, 1 tbs. sugar, 1 cup boiling water, 2 cups hot milk.

11. Divide the following recipe for pie crust in two and translate into the most convenient measures: Flour, 2 cups; lard, ⅜ cup; baking powder, ½ ts.; salt, 1 ts.; ice water, ¼ cup.

12. Make one-third of the following recipe for molasses cookies and translate it into the most convenient measures: Molasses, 1 cup; boiling water, ½ cup; flour, 2½ cups; soda, 1 ts.; ginger, 1½ ts.; butter, 4 tbs.

13. Recipe for plain lemonade: 2½ lemons to a quart of water; ½ cup sugar to a quart of water. How many glasses of lemonade will this recipe make? How many lemons and how much sugar will be needed to serve 50 persons?

14. Recipe for welsh rarebit for 6 persons: 1 tbs. butter, 1 tbs. cornstarch, 1½ c. chopped cheese, ½ ts. salt, ¼ ts. mustard, ½ c. thick cream or milk. Translate this recipe into convenient terms to serve 4 persons. Also for 1 person.

15. Recipe for rice pudding for 6 persons: ½ c. rice, ¼ ts. salt, ⅓ c. sugar, spk. grated nutmeg, 1 qt. hot milk. Alter this recipe to serve 2 persons, and state in the most convenient measures.

Marketing

It is fully as important for families of moderate means to understand how to purchase economically as to be able to increase their earnings.

Small economies in buying make money go farther. If goods that are not perishable are purchased in sufficient quantity to last for several weeks or even months, a saving in both time and money will result. Fruits and vegetables should be used freely during the season when they are abundant and should be canned or dried at this time for future use.

EXERCISE III

1. Apples can be bought at the rate of 2 for 5 cents. How much will a dozen cost?

2. Oranges cost 50 cents a dozen or 5 cents apiece. What is the actual saving in buying by the dozen?

3. Olive oil costs $3 per quart. At that rate, how much should a half-pint cost? Compare with local prices.

4. New potatoes cost 15 cents a pound or $1 a peck. What is the saving through buying by the peck?

5. Spaghetti may be bought by the 12-oz. box for 15 cents or by the 10-pound package for 90 cents. What is the per cent. of saving in buying it in the larger quantity?

6. If a cereal costs 10 cents a box and a case containing 12 boxes can be bought for $1, what is the per cent. of saving in buying it by the case?

7. Find the cost of 25 lbs. of flour if purchased by the pound at 9½ cents per lb. By the 5-lb bag at 45 cents.

8. If flour costs $1.48 for a 24½-lb. bag, what is the cost per lb.? Per cup? Per tablespoon?

9. What is the cost of one dozen bananas if 17 can be purchased for 50 cents?

10. What is the cost of a tablespoon of sugar at 9½ cents per lb.? At 10 cents per lb.?

11. The price of sugar increased from 6 to 9½ cents per lb., what is the actual increase per 25 lbs.? Per 100 lbs.? What is the per cent. of increase?

12. The usual price of sugar is 10 cents per lb. If a grocer advertises a sale of sugar at 5 lbs for 45 cents, what is the saving per lb.? The per cent. of saving?

13. If cream costs 20 cents a half pint, what is the cost of a tablespoonful? A cupful?

14. If butter costs 56 cents a lb., what is the cost of a tablespoonful? A cupful?

15. If milk costs 13 cents a quart, what is the cost per oz.? Per tbs.?

16. If the net weight of a box of rolled oats which costs 10 cents is 12 oz., what is the cost per cup? Per tablespoon?

17. Find the cost of one egg if the market price is 55 cents a dozen. 32 cents a dozen. 45 cents.

18. If eggs are sold at 40 cents a pound, find the cost of one egg. Of one dozen eggs.

19. Sliced bacon costs 12 cents per ¼ lb. What is the cost per lb.? If it can be purchased, uncut, at 7 lbs. for $3.10, what is the actual saving per lb.?

20. Vanilla costs 25 cents for a 2-oz. bottle. What is the price per teaspoonful?

21. Baking powder costs 25 cents per ½-lb. tin, or 45 cents per lb. Find the amount saved in buying 3 lbs. at the lower rate.

22. Potatoes cost 85 cents a peck, or $3 a bushel. What is the actual saving in buying 7 bushels at the lower rate? Find the cost of one quart at each rate.

23. If walnuts cost 25 cents a pound and are 58 per cent. refuse, what is the cost of one pound of walnut meats?

24. If walnuts are 30 cents a pound and 58 per cent. refuse, what is the cost of one pound of walnut meats? If walnut meats sell for $1 a pound, which is the cheaper way to buy walnuts?

25. Peanuts are 25 cents a pound and are 25 per cent. refuse. What is the cost of one pound of shelled nuts?

Dietary Principles

Planning meals is not so simple a matter as some persons seem to think. Even if a person has sufficient money with which to buy food for the family, she may not succeed in furnishing them with the kind of nourishment they should have. A diet that satisfies the appetite may lack some of the essential elements required to keep the body in a healthy, vigorous condition. There are diseases which are directly traceable to diets that are lacking in certain essential nutritive factors. Beri-beri, a disease that was prevalent in certain countries, was traced to a deficiency due to eating a diet composed largely of polished rice; that is, rice from which the germ and the bran covering had been removed. This disease can be cured by substituting unpolished rice for polished rice without making any other alterations in the diet. Investigations have shown that it is not only in poor families that there are undernourished children. Even though the quantity of food is sufficient, it may be lacking in some of the elements that are essential for health and growth.

The body is a complicated piece of machinery and it needs many different kinds of supplies to keep it in working order. First of all, it needs fuel to keep it warm. Foods which contain carbohydrates in large proportion, such as potatoes, cereals, and sugar, form the cheapest source of fuel. Fats, such as butter, lard, and olive oil, yield more fuel to the pound, but are a more expensive source of fuel and should not be used too freely in the diet, because they make the food too "rich."

There must also be a supply of material to build the body tissues and to repair waste. The tissues are constantly being used up in the daily activities of life and need to be renewed. During childhood the body increases in size and stature, and requires an additional supply of tissue building material. This is supplied in part by foods that contain protein. Foods which contain protein are milk, lean meats, and cereals, and legumes such as peas and beans. The protein in milk is most readily assimilated by the body.

Certain minerals are also needed for the building of body tissues. The bad effect of a diet furnishing an inadequate supply of mineral matter may not become evident until after a long period of time, and it may not then be discovered except by those experts who are

trained to recognize in the condition of the body the results of a lack of iron or calcium or some other mineral. An adequate supply of calcium (lime salts) is particularly important, for it is required for bones and teeth. Foods must be selected which contain these minerals in a form in which they are readily assimilated by the body. Of all the food materials there are none from which the minerals are more readily assimilated than milk. For that reason, if for no other, every one, and particularly young children, should have plenty of milk. Milk, however, cannot be relied upon to furnish all the necessary minerals, for while milk is rich in calcium it is relatively poor in iron. This may be supplied by the yolk of the egg or by fruit and vegetables which are important sources of minerals. Meats may also serve as a source of certain minerals, but they are not so desirable for this purpose as either milk or fruits and vegetables.

There are two other substances and possibly a third which must be supplied to keep the body healthy and strong. Very little is known about the nature of these substances or their exact function in digestion. When their presence in foods was discovered these substances were given the name "vitamines," but more recently the first two have been called "fat-soluble A" and "water-soluble B" because the first substance can be dissolved in fat and the second in water. The third substance is still controversial.[2] The substance called "fat-soluble A" is found most abundantly in butter-fat, milk, and egg yolk, and to a lesser extent in the leaves of plants. The "water-soluble B" is present in abundance in all natural foods except those derived from seeds from which the germ, or the bran, has been removed; *e.g.*, bolted flour, starch, sugar, rice, and fats and oils of both vegetable and animal origin. In order to promote health, to increase resistance to disease, to produce conditions which make for efficiency and long life, the diet should contain liberal amounts of milk and leafy vegetables. Milk and leafy vegetables are "protective" in character in that they correct the deficiencies in other foods. To summarize, the essentials of an adequate diet include fuel to keep the body warm, protein and mineral matter to provide tissue building material, and the substances called vitamines to maintain the conditions necessary to health and growth.

[2] See *American Journal of Children's Diseases*, April, 1919, "Factors Affecting the Anti-Scorbutic Value of Food" by A. F. Heff and L. J. Unger.

General directions for planning dietaries might be summed up as follows:

Include in the dietary: cereals, sugar, potatoes, fats, oils, and other foods that serve as fuel for the body.

Include milk and milk products, cereals and legumes, meats and eggs in order to furnish protein for building tissues.

Include milk and milk products, vegetables, fruits, and eggs, in order to secure an adequate supply of calcium, iron and other essential minerals.

Include milk, eggs, and leafy vegetables in order to supply the "protective substances" called vitamines.

Directions for planning meals are stated in the following table: [3]

Food groups	Purposes	Amount needed daily by a man at moderate muscular work
No. 1. Fruits and vegetables	To give bulk and to insure mineral and body-regulating materials	1¾ to 3 pounds
No. 2. Medium fat meats, eggs, cheese, dried legumes, and similar foods, milk	To insure enough protein	8 to 16 ounces (4 ounces of milk counting as 1 ounce)
No. 3. Wheat, corn, oats, rye, rice and other cereals, potatoes, sweet potatoes	To supply starch, a cheap fuel, and to supplement the protein from Group 2	8 to 16 ounces (increasing as foods from Group 2 decrease)
No. 4. Sugar, honey, sirup, and other foods consisting chiefly of sugar	To supply sugar, a quickly absorbed fuel, useful for flavor	1½ to 3 ounces
No. 5. Butter, oil and other foods consisting chiefly of fat	To insure fat, a fuel which gives richness	1½ to 3 ounces

Moderate muscular work would include such occupations as that of a typesetter, a letter-carrier, a motorman, a chauffeur, a carpenter, or painter. Persons who do hard manual labor would require more, those who exercise little would require less food. The directions in the table provide the variety essential to an adequate diet, but they need to be modified to supply the needs of persons of different ages and different occupations.

[3] *The Day's Food in Peace and War*, page 19.

EXERCISE IV

(Use Tables C and D, pages 184 and 188)

1. Make out a day's dietary for a typesetter in accordance with the above directions, and estimate the cost of the food.

2. Plan a day's dietary for a letter-carrier at a cost not to exceed 40 cents; 50 cents; 60 cents.

3. Make out a day's dietary for a family consisting of a carpenter, his wife who does all the housework, and three children under ten years of age. The three children will require about as much food as two adults. Estimate the cost of the food.

4. In the dietaries you have planned, which foods supply protein? Calcium? Iron? Vitamines?

5. Criticize the following day's dietary for a travelling salesman, and modify it to meet his needs.

Breakfast:	1 pork chop	4 oz.
	3 rolls	2 oz.
	Butter	1 oz.
	Potatoes	4 oz.
	Cream for coffee	1 oz.
	Sugar	½ oz.
Lunch:	2 fried eggs	4 oz.
	Ham	4 oz.
	Waffles	2 oz.
	Syrup	3 oz.
	Butter	2 oz.
Dinner:	Steak	4 oz.
	Butter	1 oz.
	Bread	2 oz.
	Potatoes	4 oz.
	Apple pie:	
	Apples	3 oz.
	Flour	½ oz.
	Fat	¼ oz.
	Sugar	½ oz.
	Cheese	½ oz.

6. Criticize the following day's dietary for a housekeeper:

Breakfast:	1 slice toast	1 oz.
	Butter	¼ oz.
	Cream for coffee	½ oz.
	Sugar	½ oz.

Lunch:	2 sandwiches:		
	Bread	4	oz.
	Butter	1	oz.
	Cheese	1	oz.
	1 glass milk	8	oz.
	1 apple	4	oz.
Dinner:	Canned baked beans	4	oz.
	Canned tomatoes	3	oz.
	Bread	3	oz.
	Butter	1	oz.
	Sugar for coffee	½	oz.
	Cream	½	oz.
	Stewed prunes	5	oz.

7. Does the dietary in example 19 on page 159 fulfill the requirements with regard to vegetables and fruit? How would you modify this dietary to conform to the above standard? What would be the increase in cost?

8. Find the weight of the different groups of foods in the dietary in example 17 on page 158. How would you alter this dietary to serve a family of four persons of whom two are children?

9. From the following list of foods make out a day's dietary for a child of nine years who requires about six-tenths as much food as a man at moderate muscular exercise. Estimate the cost of the dietary:

Breakfast:
Orange or stewed prunes or baked apple
Oatmeal or other well-cooked cereal
Milk
Toast and butter.

Dinner:
Soft-cooked egg or small portion of meat
Potatoes
Carrots or parsnips or onions or spinach
Milk
Bread or rice or hominy
Butter or jelly
Pudding or cake or cookies.

Supper:
Cream soup or milk on porridge or rice or milk toast
Bread and butter
Pudding or stewed fruit.

FOOD BUDGETS

The following budgets may be suggestive in determining the amount of money to be spent for each of the five divisions of foods. They have been worked out in such a way as to insure an ample

amount of calcium, iron, and other minerals, as well as vitamines, provided that the amount of money spent for food is sufficient to furnish an adequate supply of fuel for the needs of the body:

Food Budget, or Division of Food Money, for a Minimum Income[4]

	Per cent.
1. Fruits and vegetables	20
2. (*a*) Meat, fish, eggs, etc.	20
(*b*) Milk	20
3. Cereals	25
4. Sugars and condiments	5
5. Fats	10

Dr. H. C. Sherman's Suggested Food Budgets[5]

	Per cent.
Meat, poultry, and fish	10–15
Eggs	5–7
Milk	25–30
Cheese	2– 3
Butter and other fats	10–12
Bread, cereals and other grain products	12–15
Sugar and other sweets	About 3
Vegetables and fruits	15–18

EXERCISE V

1. A family has $15 a week to spend for food. What would you allow for each of the five groups using the budget for the minimum income? With the amount of money allowed for milk, how many quarts a day could be bought?

2. If there are two adults and four children in the family, what would you buy with the money allowed for meat, fish, and eggs?

3. A family consisting of two adults and three children under ten years of age has an income of $2000. What amount may be allowed for food each week? What may be allowed for each division of the food budget? Make a list of the vegetables and fruits for this family for a week, using the current prices.

4. Classify the expenditures for food recorded in the cash accounts in examples 3 and 4, pages 32 and 33, and find what per cent. was spent for each class of foods. How closely do the expenditures conform to either of the suggested budgets? What criticisms would you make? What changes?

[4] Modified from a budget used by social workers.

[5] *The Chemistry of Food and Nutrition*, H. C. Sherman, used by permission of and arrangement with the Macmillan Company, Publishers.

5. Plan a week's dietary for a family of two adults and two children under 12 years of age if $12.50 is allowed for food.

6. Keep an accurate account of the food purchased for use in your home for a week. Find what per cent. of the total is spent for each class of foods and how closely these percentages conform to either of the suggested budgets.

7. Plan a week's dietary for your family.

Food as Fuel and Tissue-Building Material

The directions that have been given serve in a general way to show how meals should be planned to provide the kinds of food needed to keep the body warm and to provide materials for building tissues and for maintaining the conditions essential to health and growth. It is possible to measure the amount of fuel and of tissue-building material that is supplied by different foods and in this way to plan dietaries that meet the needs of persons of different ages and occupations. Not enough is known about the so-called vitamines, however, to measure them, and for that reason dietaries should be planned to include milk, eggs, and leafy vegetables in which they are known to be present in order to supply any deficiencies that might otherwise occur.

When food is used as fuel to provide heat for the body, its value is measured not by its weight or quantity, but by its heat-producing power. The amount of heat produced when any substance is burned can be measured by the effect of the heat upon a certain amount of water.

Since foodstuffs are burned in the body, the amount of heat they yield is measured by using them as fuel to heat a certain amount of water and observing the change in temperature of the water. These observations have to be made with scientific instruments especially prepared for the purpose.

The amount of heat required to warm a pound, *i.e.*, approximately a pint of water 4 degrees Fahrenheit is called a Large Calorie (or simply a Calorie). For example: if the temperature of 1 pound of water were 60 degrees Fahrenheit, it would require 1 Calorie of heat to raise the temperature to 64 degrees.

The precise scientific definition of a Calorie is the amount of heat required to raise the temperature of one kilogram of water 1 degree Centigrade.

The fuel value of foods has been determined by scientists, and the results of their investigations have made it possible to estimate the heat-producing power of food materials.

A table of the fuel value of common food materials is given on page 175. By means of this table of the fuel value of foods, it is possible to estimate the fuel value of the food materials in menus and dietaries.

FUEL REQUIREMENTS

The amount of fuel needed by each person depends to some extent upon his occupation, his age, his height, and his weight. Tall, thin persons require more fuel than short, fat persons, because they have more radiating surface in proportion to their weight. Persons who are engaged in active manual labor, such as washing clothes or sawing wood, require more fuel than those who spend a large part of their time writing at a desk or sewing. More fuel is required by children in proportion to their weight than by older persons both because they are more active and because they are growing and must have more material to provide for their increasing size.

If an adult's occupation is known, his fuel requirement may be estimated from the following tables:[6]

TABLE I. FUEL REQUIREMENT FOR ADULTS

Approximate Energy Requirements of Average-sized Man

	Calories per pound of body weight per hour
Sleeping	0.4
Sitting quietly	0.6
At light muscular exercise	1.0
At active muscular exercise	2.0
At severe muscular exercise	3.0

TABLE II. FUEL REQUIREMENT DURING GROWTH

Approximate energy requirement for children, allowing for moderate exercise.

Age in years	Calories per pound of body weight per day
Under 1	45
1–2	45–40
2–5	40–36
6–9	36–30
10–13	30–27
14–17	27–20
17–25	not less than 18

[6] Kinne and Cooley. *Foods and Household Management*, pages 299–301. Used by permission of and special arrangement with the Macmillan Company, Publishers.

Light exercise may be considered to mean such work as running a sewing machine, or standing at a stove, or walking. Stenographers, teachers, and seamstresses do little work heavier than this.

Active exercise involves use of more muscles. General houseworkers and delivery boys do about this grade of work.

Severe exercise causes strain which hardens and enlarges the muscles. Active sports such as swimming, bicycling up hill, and hard labor such as washing and gardening, are typical of this grade of work.

Still heavier work such as is done by lumbermen and excavators demands an even greater allowance of food for fuel.

In estimating the allowance of food for children, due consideration must be given to their greater activity, and the estimates in Table II should usually be considered as the minimum fuel requirement.

EXERCISE VI

Problem.—Estimate the probable energy requirement of a stenographer, 28 years old, weighing 125 pounds, whose time is divided each day about as follows: Sleeping, 8 hours; sitting quietly at meals, reading, taking dictation, etc., 8 hours; at light muscular exercise, dressing,, standing, walking, typing, etc., 6 hours; at active muscular exercise, playing tennis, etc., 2 hours. Use Table I.

8×0.4 Calories $= 3.2$ Calories per pound of body weight
8×0.6 Calories $= 4.8$ Calories per pound of body weight
6×1.0 Calories $= 6.$ Calories per pound of body weight
2×2.0 Calories $= 4.$ Calories per pound of body weight

Total Calories per pound per day $= 18.$
$125 \times 18 = 2250$, total Calories per day.

From the tables on page 131 find the total fuel requirement per day for each of the following individuals:

1. A teacher 30 years old who weighs 145 pounds, and whose daily schedule is as follows: Sleeping, 8 hours; sitting quietly, 5 hours; at active exercise, 1 hour; at light exercise, 10 hours.

2. A general houseworker, 42 years old, who weighs 152 pounds and whose daily schedule is as follows: Sleeping, 8 hours; sitting, 4 hours; at active exercise, 8 hours; at light exercise, 4 hours.

3. A laundress, 50 years old, who weighs 170 pounds and whose daily schedule is as follows: Sleeping, 8 hours; sitting quietly, 3 hours; at active exercise, 9 hours; at light exercise, 4 hours.

4. Make out time schedules for your parents, and calculate their probable energy requirements.

5. Estimate the probable energy requirement of a day laborer who weighs 170 pounds; a dentist who weighs 180 pounds.

Estimate the probable fuel requirement for the following young persons and tabulate the results:

6. A child, 5 years old, who weighs 42 pounds.
7. A child, 8 years old, who weighs 46 pounds.
8. A boy, 10 years old, who weighs 62 pounds.
9. A messenger boy, 14 years old, who weighs 97 pounds.
10. A nursemaid, 15 years old, who weighs 106 pounds.
11. A farm hand, 16 years old, who weighs 140 pounds.
12. A school girl, 16 years old, who weighs 109 pounds.
13. A policeman, 22 years old, who weighs 160 pounds.
14. A stenographer, 22 years old, who weighs 125 pounds.
15. Estimate your own fuel requirements.
16. Estimate the fuel requirements of your own family.

Estimate the probable fuel requirements per pound body weight of the following persons and tabulate the results:

17. A carpenter, of average weight (154 pounds), whose daily schedule includes 8 hours sleeping, 6 hours sitting, 4 hours at light exercise and 6 hours at active exercise.

18. A houseworker, of average weight (123 pounds), whose daily schedule is similar to that of the carpenter in the preceding problem.

19. A bookkeeper, of average weight (154 pounds), who sleeps 7 hours, sits 10 hours, and stands at desk or walks 7 hours.

20. A seamstress, of average weight (123 pounds), whose daily schedule is similar to that of the bookkeeper in the preceding problem.

21. A salesman, of average weight (154 pounds), who sleeps 8 hours, sits quietly 4 hours, stands or walks 10 hours, and exercises actively for 2 hours.

22. A saleswoman, of average weight (123 pounds), whose daily schedule is similar to that of the man.

EXERCISE VII

The use of scientific standards of food requirements frequently necessitates conversion from kilograms to pounds or vice versa. [One pound equals .454 kilograms. One kilogram equals 2.2

pounds. See also Metric Equivalent Measures, Table E, page 190] (Fig. 25).

1. The average weight of a man is said to be approximately 70 kilograms, of a woman 56 kilograms. Express these average weights in pounds.

2. Sill allows 80 Calories per kilogram per day for children between 6 and 9 years old. How does this allowance compare with the standards on page 131?

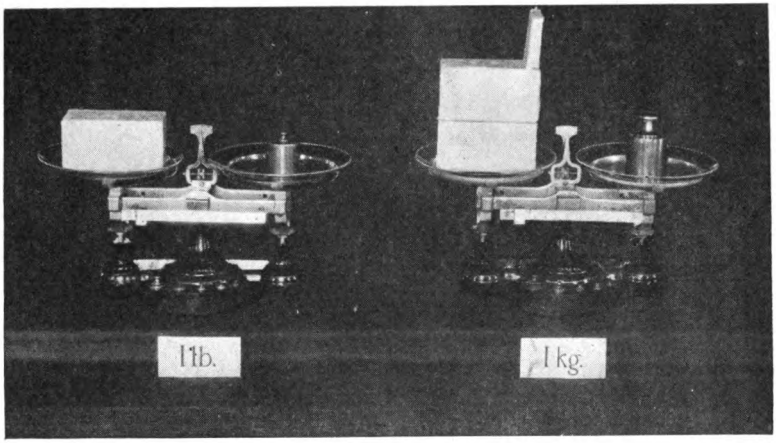

FIG. 25.—1 kilogram equals 2.2 pounds.

3. The average weights of children from birth to 4 years are given in kilograms in the following table.[7] Find the weights in pounds and tabulate:

Age	Kilograms	Pounds
At birth	3.4	
6 months	6.8	
1 year	9.5	
2 years—boys	13.8	
girls	13.3	
3 years—boys	15.9	
girls	15.0	
4 years—boys	17.2	
girls	16.5	

[7] Sill. *New York Medical Journal*, Jan. 14, 1911, p. 70.

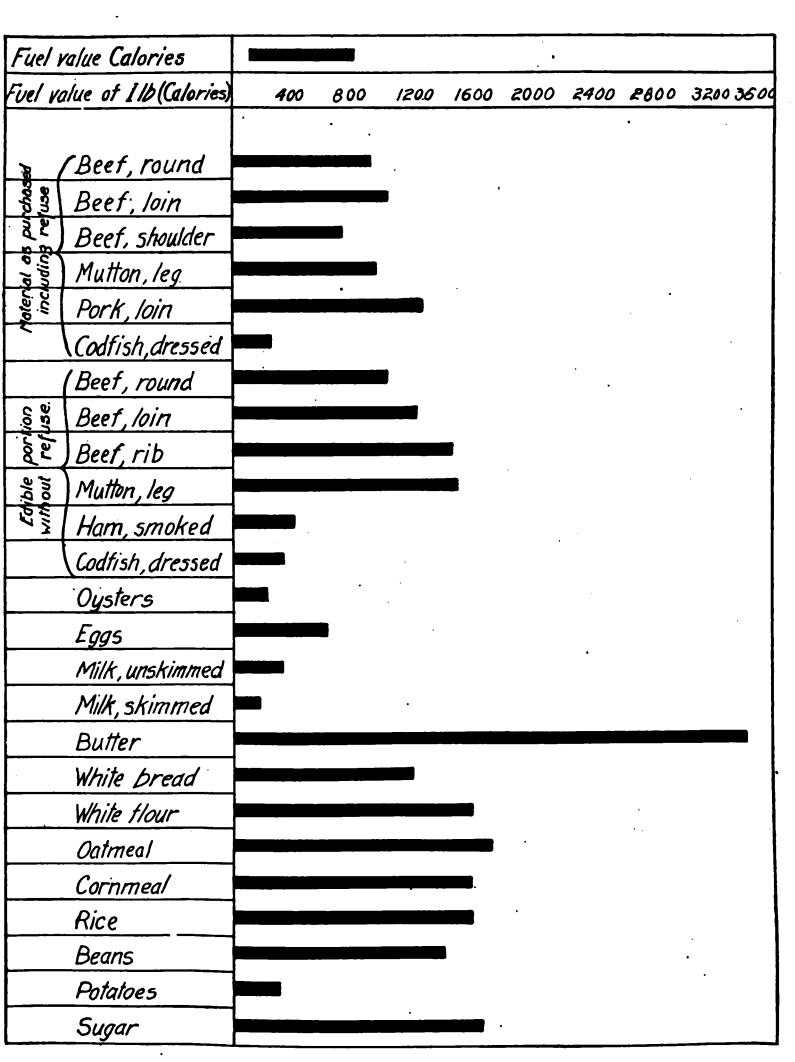

FIG. 26.—Fuel value of food materials.
From Bulletin No. 142, U. S. Department of Agriculture.

FUEL VALUE OF FOODS

The value of certain common foods as sources of heat is represented graphically in Fig. 26. Opposite the name of each food material in the chart is a broad black line every $\frac{5}{16}$ of an inch on which is a unit and represents 400 Calories. The number of Calories produced per pound is indicated by the number of units in the length of the line. Thus, the line opposite round of beef is $2\frac{1}{4}$ units long, and since $2\frac{1}{4}$ units = 900, round of beef yields approximately 900 Calories per pound. Similarly, dressed cod, which is followed by a line only $\frac{1}{2}$ a unit long, yields only approximately 200 Calories per pound.

EXERCISE VIII

Estimate from the chart the number of Calories per pound yielded by each of the following foods:

1. Mutton, leg.
2. Pork, loin.
3. Eggs.
4. Milk, whole.
5. Milk, skimmed.

6. Name five of the foods in the chart that yield a large number of Calories per pound.

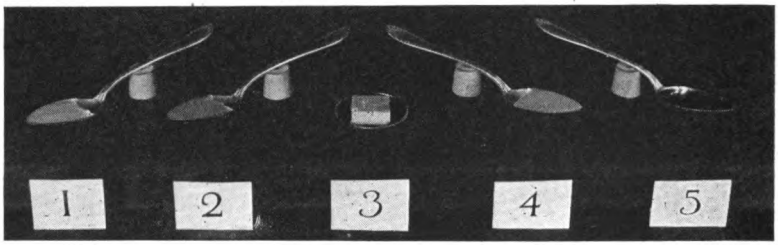

FIG. 27.—**100-Calorie portions of fats. 1.** Lard, or lard substitute, 0.4 oz., 1 scant tbs.; **2.** Butter, 0.5 oz., 1 scant tbs.; **3.** Butter, 0.5 oz., 1 piece 1⅛″ x 1⅛″ x 1⅛″; **4.** Oleomargarine, 0.5 oz., 1 scant tbs.; **5.** Olive oil or other vegetable oil, 0.4 oz., 1 scant tbs.

7. Name five of the foods in the chart that yield a small number of Calories per pound.

8. Why does butter yield the largest number of Calories per pound of the foods in the chart?

9. How would the number of Calories yielded by olive oil compare with the number yielded by butter? Why?

EXERCISE IX

The fuel value per pound of the common food materials is given in a bulletin published by the U. S. Department of Agriculture. The figures are the result of scientific experiments covering a period of years, and they represent the averages of many different tests under the most expert supervision.[8]

By referring to Table A, page 175, the student will find after the names of each food material seven columns. The first six columns contain numbers that represent the per cent. of the different nutrients in the food. The last column contains a number that represents its fuel value expressed in Calories per pound.

Thus, chuck ribs of beef is made up of 16.3 per cent. refuse, 52.6 per cent. water, 15.5 per cent. protein, 15 per cent. fat, no carbohydrates, 0.8 per cent. mineral ash. One pound of this meat produces 910 Calories.

For the present the student may disregard the chemical composition and refer only to the column headed "Fuel value per pound."

1. Read from the table the number of Calories produced by one pound of each of the following food materials:

a. Fruits and vegetables:
- Lettuce
- Green corn
- Onions
- Cabbage
- Apples
- Bananas

b. Meats, fish, milk, eggs, etc.:
- Sirloin beeksteak
- Beef, rump
- Leg of lamb
- Fresh pork chops
- Halibut steak
- Cheddar cheese
- Hen's eggs
- Peanuts
- Dried beans
- Whole milk
- Skimmed milk
- Buttermilk

c. Cereal food:
- Entire wheat flour
- Graham flour
- Macaroni
- Cornmeal
- Oat breakfast food
- White bread

d. Sugars:
- Sugar
- Molasses
- Honey

e. Fats:
- Butter
- Bacon
- Cream

2. Find the number of Calories per one-half pound of each of the above food materials.

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[8] *Principles of Nutrition and Nutritive Value of Food.* U. S. Department of Agriculture. Farmers' Bulletin No. 142.

3. Estimate the fuel value of 5 ounces of each of the above food materials.

4. Estimate the fuel value of

1 c. milk
1 c. butter
1 tbs. butter
1 c. rice
1 c. flour
1 tbs. sugar
1 egg
1 orange
1 square bitter chocolate
1 loaf bread

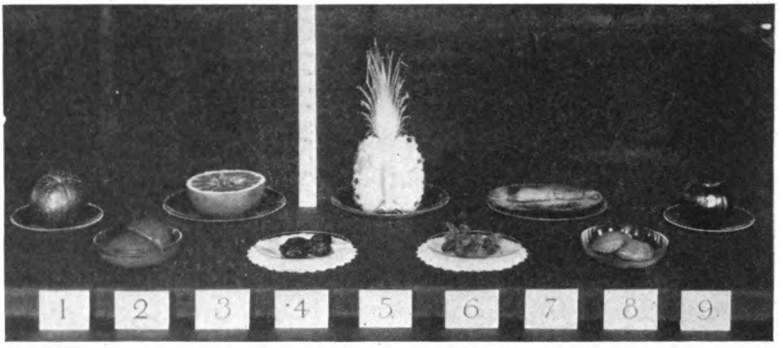

FIG. 28.—**100-Calorie portions of fruits.** 1. Orange, 9.5 oz., 1 large (3″ diam.); 2 Peaches, canned, 7.5 oz., 2 large halves (2½″-3″ diam.); 3. Grape Fruit, 12.5 oz., ½ large (4½″ diam.); 4. Prunes, 1.4 oz., 4 medium (size 40-50); 5. Pineapple, 15.0 oz., ½ small (4″ diam.); 6. Raisins, 1. 1 oz., ¼ cup (18 large); 7. Banana, 5.5 oz., 1 large (6½″x 1½″); 8. Pears, canned, 4.7 oz., 2 halves (2″ diam.); 9. Apple, 7.5 oz., 1 large (3″ diam.).

5. Estimate the fuel value and cost of the following recipes:

a. Plain muffins
1 c. flour
1 egg
1¼ c. milk (skimmed)
1 tbs. sugar
1 tbs. butter

b. White sauce for vegetables
2 tbs. flour
2 tbs. butter
1 c. milk (skimmed)

c. Home-made ice cream
2 c. milk (whole)
2 c. cream
1 c. sugar
2 tbs. flour
2 eggs
1 tbs. vanilla (this has no fuel value)

d. Plain cake
¼ c. butter
1 c. sugar
2 eggs
½ c. milk
1½ c. flour
2 ts. baking powder
spk. salt
½ ts. vanilla

e. Barley sponge cake
1½ c. barley flour (fuel value of 1 lb. = 1596 Calories)
4 eggs
1½ c. corn syrup (fuel value of 1 lb. = 1266 Calories)
1 tbs. lemon juice
¼ ts. salt
2 ts. baking powder

6. The following dietary provides food for a week for a family of five persons. The father is a clerk, the son is at school most of the day, and the wife is a thin person who is, however, well able to do the work. Find the number of Calories furnished by the food and the cost at the current local prices: [9]

Food Material	Pounds	Food Material	Pounds
Beef soup meat	4	Corn syrup	2
Codfish	1	Beans	2
Eggs, 1 dozen		Carrots	4
Fats of various kinds	1	Onions	4
Milk, 21 quarts		Potatoes	15
Cheese	½	Apples	4
Bread	12	Prunes	2
Macaroni	1	Cocoa	½
Rice	1	Tea	½
Oatmeal	3	Coffee	½
Sugar	2	Dates	1

The Relative Cost of Foods as Sources of Fuel

One important method of estimating the relative cost of foods is to find the cost of each kind of food as a source of fuel. This method leaves out of consideration the value of these food materials as sources of protein, mineral materials and vitamines, without which the diet would be wholly inadequate.

But since fuel for the body is a large item in the dietary requirement, it is desirable to know which foods are cheap sources of heat.

EXERCISE X

Problem.—How many pounds of dried beef at 45 cents a pound can be purchased for $1? How many Calories will this amount of dried beef yield?

Let x = the number of pounds of dried beef to be bought for $1.

Then $\frac{.45}{1.00} = \frac{1}{x}$

$x = 2.2$ approximately, that is, 2.2 lbs. can be bought for $1.

One pound yields 790 Calories.

Hence, 2.2 lb. yield 2.2×790 Calories, or 1738 Calories.

That is, $1 will buy 1738 Calories.

The results may be tabulated as follows:

Cost of Energy Derived From Foods.

Name.....

Date.....

Name of Food	Price per pound	Pounds for $1.00	Calories for $1.00
Dried beef	$.45	2.2	1738

[9] This dietary is taken from *The Day's Food in War and Peace*, published by the U. S. Food Administration, Department of Agriculture.

Classify the following list of foods in the five groups, find the amount of each food and the total number of Calories that can be purchased for $1, and tabulate the results, arranging the foods in each group in the order of economy as to fuel value:

1. Butter
2. Whole milk
3. Eggs
4. American cheese
5. Roast beef
6. Rolled oats
7. Sugar, granulated
8. Wheat bread
9. White flour
10. Cornmeal
11. Oysters
12. Tomatoes
13. Turkey
14. Beans, dried
15. Cornflakes
16. Dates
17. Soda crackers
18. Raisins
19. Walnuts
20. Bananas
21. Apples

22. Illustrate graphically the relative amount of fuel that can be obtained from one dollar's worth of any five of the above foods, and arrange in order of economy.

EXERCISE XI

Another method of comparing the relative fuel value of foods is to find the cost of 1000 Calories furnished by the various fuel-producing food materials. In estimating the relative cost of foods as sources of fuel, it must be remembered that foods such as leafy vegetables, which are primarily of value because they furnish minerals and increase the bulk of the food, cannot be compared on the basis of their fuel value.

Problem.—Find the weight and cost of 1000 Calories derived from butter.

From the table on page 175, butter yields 3410 Calories per pound, *i.e.*, per 16 ounces.

Let x represent the number of ounces required to yield 1000 Calories.

Then $\frac{x}{16} = \frac{1000}{3410}$

That is, $x = 4.7$, the number of ounces of butter required to yield 1000 Calories.

If the market price of butter is 58 cents per pound, 4.7 ounces will cost 17 cents.

In other words, 1000 Calories can be obtained from 4.7 ounces of butter at a cost of 17 cents.

Using the local prices, find the cost of 1000 Calories of the following foods and arrange the results in groups according to the classification on page 126. The least expensive source of fuel should be placed first in each group and the others should be arranged in order of economy.

1. Bacon
2. Bananas
3. Beans, baked, canned
4. Beans, dried
5. Beef loin
6. Beef, round
7. Bread, white
8. Butter
   - 35 c. per lb.
   - 48 c. per lb.
   - 55 c. per lb.
9. Carrots
10. Cheese, American pale
11. Cheese, cream
12. Chicken
13. Chocolate
14. Cornflakes
15. Crackers, soda
16. Cream
17. Dates
18. Eggs
    - 35 c. per doz.
    - 45 c. per doz.
    - 55 c. per doz.
    - 70 c. per doz.
19. Lard
20. Lettuce
21. Liver, veal
22. Macaroni
23. Milk, skimmed
24. Milk, whole
25. Mutton, leg
26. Oleomargarine [10]
27. Oranges
28. Oysters
29. Peanuts
30. Potatoes
31. Prunes, dried [10]
32. Raisins
33. Rice
34. Salmon, canned
35. Walnuts

EXERCISE XII

Arrange the foods in the preceding list in four columns in order of economy as follows:

Group I.—Less than 10 cents per 1000 calories.
Group II.—Ten to 20 cents per 1000 Calories.
Group III.—Twenty-one to 40 cents per 1000 Calories.
Group IV.—Over 40 cents per 1000 Calories.

[10] Oleomargarine: Fuel value per pound, 3525 Calories; Prunes: Fuel value per pound, 1400 Calories.

EXERCISE XIII

Arrange the following kinds of shortening in the order of economy per 1000 Calories and illustrate graphically:

1. Butter
2. Oleomargarine
3. Cream
4. Lard
5. Crisco
6. Olive oil
7. Cotton-seed table oil (4080 Calories per pound).

Arrange the following protein foods in the order of economy per 1000 Calories and illustrate graphically:

8. Round of beef
9. Leg of mutton
10. American pale cheese
11. Peanuts
12. Rolled oats
13. Eggs
14. Dried beans
15. Milk

EXERCISE XIV

In estimating the necessary expenditure for food for a family, the dietary standards on page 131 may serve as a guide to show how much fuel is actually needed by each individual. When the total requirement for the family has been determined, the total cost can be estimated from the table giving the cost per 1000 Calories. It is evident that, for an economical diet, much of the food should be chosen from the group "less than 10 cents per 1000 Calories."

1. Is it possible to supply the necessary fuel requirement for a general houseworker requiring about 3000 Calories per day, if 50 cents per day is allowed for food? What will be the average cost of the food per 1000 Calories? From which of the groups of foods in the table on page 141 would you select most of the foods?

2. If 55 cents per day is allowed for the same person?

3. If 70 cents per day is allowed for the same person?

4. A family of 2 adults and 5 children is allowed $12.50 per week for food. If their total energy requirement per day is 13,000 Calories, what is the average allowance per 1000 Calories? Discuss.

5. If $15 is allowed for the same family?

6. If $20 is allowed for the same family?

7. According to the theoretical division of income given in Table II on page 19, how much may a family of four, whose income

is $1200 a year, spend per year for food? How much per month? Per day? If the daily fuel requirment is 11,000 Colories, what should be the average cost per 1000 Calories?

8. If the income of the family in problem 13 is $1500, find the average cost per 1000 Calories.

9. If the income for the same family is $2000, from which groups of foods in the table on page 141 may the foods be selected? If $3000?

10. How much per 1000 Calories is available for foods on an

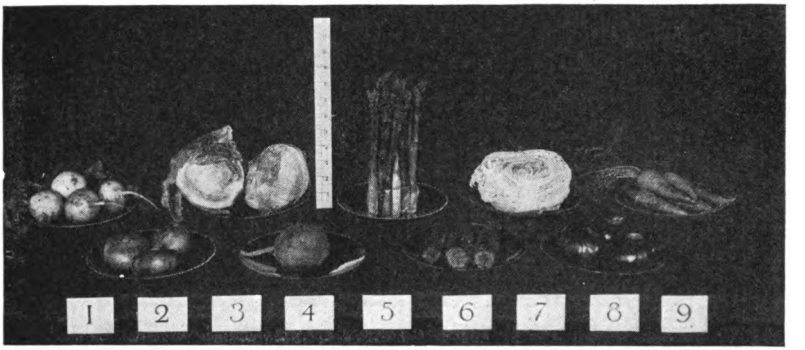

FIG. 29.—**100-Calorie portions of vegetables.** 1. Turnips, 12.9 oz., 4 turnips (2″ diam.); 2. Onions, 8.0 oz., ¾ medium (2½″-3″ diam.); 3. Lettuce, 22.3, oz., 2 large heads (4″ x 5″); 4. Potatoes, 5.3 oz., 1 medium (2½″ diam.); 5. Asparagus, 15.9 oz., 20 8″ pieces; 6. Corn, 9.0 oz., 2 6″ ears or 3 4″ ears; 7. Cabbage, 13.3 oz., ½ medium (6″ by 4″); 8. Tomatoes, 15.5 oz., 2–3 medium (2½″-3″ diam.); 9. Carrots, 10.1 oz., 4–5 (3″-4″).

income of $2000 for a family whose daily energy requirement is 13,000 Calories?

11. In an experiment in economical feeding in New York City, in 1917, 25 cents per day was allowed for food for an average sized policeman, weighing 160 pounds. Estimate the energy requirement of the policeman and find the cost of the food per 1000 Calories.

12. In a similar experiment in Chicago 45 cents per day was allowed. Find the average cost per 1000 Calories.

13. If the average cost of food is reduced from 29 cents per 1000 Calories to 25, what is the per cent. of saving?

14. If the average cost per 1000 Calories is reduced from 28 cents to 25 cents, what is the actual saving? The per cent. of saving?

15. If this rate of saving could be maintained, what would be saved in a week by a family that require 12,000 Calories per day?

16. If the average cost per 1000 Calories is reduced from 35 cents to 25 cents, what is the per cent. of saving? How much would be saved in a month (30 days) by a family of six whose daily fuel requirement is 13,500?

17. Mrs. Montgomery found, after a study of the dietary for her family, that the average cost per 1000 Calories was about 33

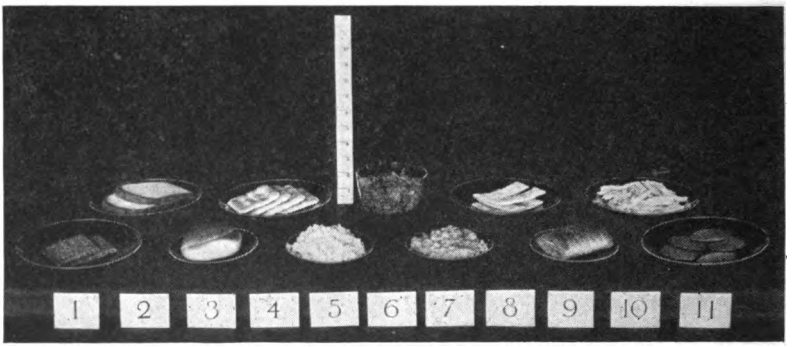

FIG. 30.—**100-Calorie portions of cereals and cereal products.** **1.** Graham crackers, 0.8 oz., 2 crackers; **2.** Bread, white, 1.4 oz., 2 slices 3″ x 3½″ x ½″; **3.** Roll, 1.3 oz., 1 roll, 2″ x 3″ x 2″; **4.** Soda crackers, 0.9 oz., 4, 3″ x 3″; **5.** Steamed Rice, 4.0 oz., ¾ c.; **6.** Cornflakes 1.0 oz., 1¼ c.; **7.** Rolled oats, cooked, 4.5 oz., ⅔ c.; **8.** Saltines, 0.9 oz., 6 saltines; **9.** Shredded Wheat, 1.0 oz., 1 biscuit; **10.** Macaroni, cooked, 5.2 oz., 1 c.; **11.** Vanilla wafers, 0.8 oz., 5, 2″ wafers.

cents. By careful management, she was able to reduce this to 30 cents per 1000 Calories. What per cent. of saving did she make?

18. There are five in Mrs. Montgomery's family, and their daily fuel requirement is 12,000 Calories. At 33 cents per 1000 Calories, find the cost of food per month (30 days). How much did she save by reducing the cost to 30 cents per 1000 Calories?

100-CALORIE PORTION

For the sake of simplifying the process of computing the fuel value of foodstuffs in every-day use, a standard portion has been adopted. This standard portion is the amount of food required to yield 100 Calories, and it is commonly called the 100-Calorie portion. In many cases the 100-Calorie portion corresponds to the

amount of food usually served to one person at a time. Thus, one shredded wheat yields 100 Calories (Fig. 30) and is a standard portion; one average potato is a 100-Calorie portion (Fig. 29); one large orange or one large apple (Fig. 28).

The weight of 100-Calorie portions of common food materials can be computed from the table of the Composition of American Food Materials on page 175.

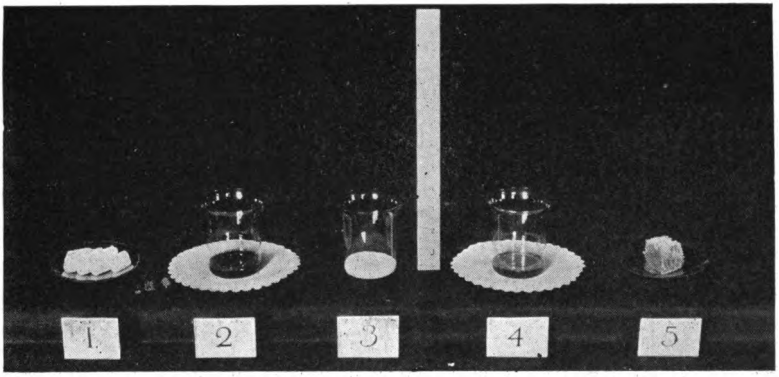

FIG. 31.—**100-Calorie portions of sugar and other sweeteners. 1.** Loaf sugar, 0.9 oz., 3½ full sized pieces; **2.** Molasses, 1.2 oz., 2 scant tbs.; **3.** Granulated sugar, 0.9 oz., 2 scant tbs.; **4.** Corn syrup, 1.1 oz., 2 scant tbs.; **5.** Honey, 1.1 oz., 1⅛″ cube.

EXERCISE XV

Problem.—Find the weight of a 100-Calorie portion of granulated sugar and translate the result into terms of household measures.

One pound of sugar yields 1750 Calories.
(See the Table on page 175.)
1 lb. = 16 oz.
Let x = the number of ounces in a 100-Calorie portion;

Then $\frac{x}{16} = \frac{100}{1750}$

$x = .9 +$

That is, .9 oz. of granulated sugar yields 100 Calories.
Hence a little less than two tablespoonsful of sugar yields 100 Calories (Fig. 31).

Find the number of ounces in a 100-Calorie portion of the following food materials, and tabulate the results. Translate the results when possible into terms of household measures.

Food	Calories per lb.
1. Smoked ham	1635
2. Corned beef	1245
3. Oysters	225
4. Butter	3410
5. Entire wheat flour	1650
6. Rice	1620
7. Cheddar cheese	2075
8. Milk, whole	310
9. Buttermilk	160
10. Peanuts	1775

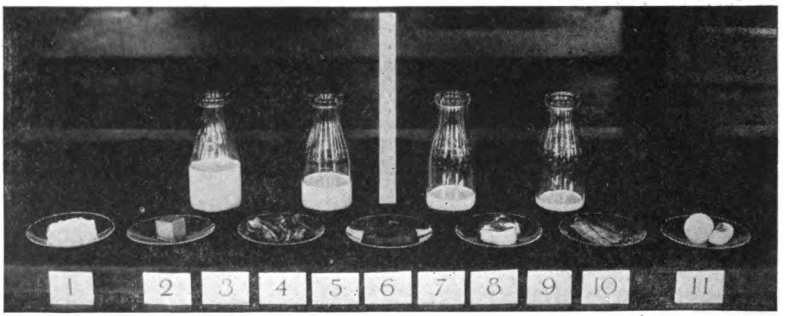

FIG. 32.—**100-Calorie portions of protein-containing foods.** **1.** Cottage cheese, 3.2 oz., ⅓ c.; **2.** American cheese, 0.8 oz., 1 ⅛″ cube; **3.** Skimmed milk, 9.6 oz., 1⅛ c.; **4.** Broiled bacon, 0.5 oz., 4-5 slices ½″ x 4″; **5.** Whole milk, 5.1 oz., ⅝ c.; **6.** Beef round, 1.7 oz., 2″ x 3″ x ½ ″; **7.** 18% cream, 1.8 oz., ¼ c.; **8.** Lamb chop, 1.3 oz., 2″ x 2″ x ½″; **9.** 40% of cream, 0.9 oz., 1⅓ tbs.; **10.** Sardines, 1.7 oz., 3-6; **11.** Eggs, 2.7 oz., 1⅓ eggs.

DIETARIES

The fuel value of a combination of foods can be computed by means of a table giving the weights and measures of 100-Calorie portions of the ordinary foods. A list of 100-Calorie portions will be found in Table B, page 179.

When any food material or combination of food materials is not found in the table, the student should compute the fuel value from the table of The Composition of Common American Food Materials. (Table A, page 175.)

For equivalent weights and measures of the ordinary food materials, the student is referred to Tables C and D, pages 184 and 188.

Although protein is not used primarily as fuel in the body and its dietary value lies in the fact that it serves to supply the kind of material needed to build and repair tissues, nevertheless protein may serve as a source of fuel (Fig. 32). For that reason the amount of protein in the diet can be stated in terms of Calories instead of ounces. If the number of Calories supplied by protein in a day's dietary is not less than 10 per cent. nor more than 15 per cent. of the total number of Calories supplied, the amount of protein in the day's dietary will satisfy the body requirements.

EXERCISE XVI

Problem.—Find the total number of Calories yielded by ⅛ pound of butter.

From the table of 100-Calorie portions, .5 oz. of butter yields 100 Calories. (Fig. 27.)

Since .5 oz. is contained in ⅛ pound, or 2 oz., 4 times, ⅛ pound of butter yields 4 times 100 Calories or 400 Calories.

Problem.—Find the total number of Calories yielded by 1 cup of cocoa.

From the table of 100-Calorie portions, ¾ of a cup of cocoa yields 100 Calories.

Since ¾ cup is contained in 1 cup 1⅓ times, 1 cup of cocoa yields 1⅓ times 100 Calories or 167 Calories.

State the answers to the nearest unit, thus 33.3 Calories should be called 33 Calories, but 33.5 Calories should be called 34 Calories.

Find the number of standard portions, and the total number of Calories yielded by each of the following foods (use Table B, page 179):

1. 1 shredded wheat biscuit
2. 2 slices of bread
3. 4 tbs. of butter
4. 8 oz. cornflakes
5. 12 peanuts
6. 3 tbs. granulated sugar
7. 3 large eggs (1 large egg equals 1⅓ medium-sized eggs)
8. 1 medium-sized egg
9. 3 large doughnuts
10. 1 tbs. cream (thick)
11. 1 cup whole milk
12. 4 dates
13. 1 fig
14. 1 pt. whole milk

15. ¼ cup whole milk
16. 1 cup skimmed milk
17. 3 cups whole milk
18. 1 tbs. cream (18 per cent.)
19. ½ lb. roast beef
20. ⅛ cup skimmed-milk

EXERCISE XVII

Problem.—Find the number of 100-Calorie portions, and the total Calories, and the number of Calories yielded by protein in a 14-cent loaf of bread weighing 22 oz.

From the table of 100-Calorie portions 1.4 oz. of bread yields 100 Calories, of which 14 are from protein.

Let x = the number of 100-Calorie portions in 22 oz.

Then $\frac{1.4}{22} = \frac{1}{x}$

Solving, $x = 16$, approximately, the number of 100-Calorie portions.
$16 \times 100 = 1600$, the number of Calories yielded by 22 oz. of bread.
$16 \times 14 = 224$, the number of Calories yielded by the protein.

Find the number of standard portions, the total number of Calories in each of the following foods (use Table B, page 179):

1. 8 saltines
2. 1 lamb chop (as purchased)
3. 1 graham cracker
4. ½ lb. walnuts (shelled)
5. 3 slices zwieback
6. 1 large orange
7. 6 lb. roast beef
8. 1 glass buttermilk
9. 1 qt. oysters (28 oysters)
10. 1 cup skimmed-milk
11. 1 cup cornflakes
12. 1 cup bean soup
13. 1 cup beef juice
14. 1 pt. peanuts (5 oz.)
15. 1 lb. raisins
16. 1 doz. eggs
17. ½ lb. brown sugar
18. 1 can tomatoes (32 oz.)

EXERCISE XVIII

In many of the simple combinations of foods that are commonly used, such as crackers and cheese, bread and butter, bread and milk, the amount of fuel derived from protein is not less than 10 per cent. nor more than 15 per cent. of the total fuel value of the foods. For that reason such combinations of foods can be added to the menu without altering the relative amount of protein in the day's dietary.

Problem.—Find the total number of Calories, the number of Calories yielded by protein, the total cost, and the cost per 1000 Calories of the following combination of food materials:

2 oz. of American pale cheese and 8 soda crackers.

From the table of 100-Calorie portions .8 oz. of cheese yields 100 Calories of which 26 are from protein.

Let x = the number of 100-Calorie portions in ⅛ lb. or 2 oz. of cheese.

Then $\frac{.8}{2} = \frac{1}{x}$

Solving $x = 2.5$, the number of 100-Calorie portions.

$2.5 \times 100 = 250$, the number of Calories yielded by 2 oz. of cheese.

$2.5 \times 26 = 65$, the number of Calories yielded by the protein.

From the table, 8 soda crackers yield 200 Calories, of which 20 are from protein.

$250 + 200 = 450$, the total number of Calories yielded by the food.

$20 + 65 = 85$, the total amount of Calories yielded by the protein.

$\frac{85}{450} = 19$ per cent. approximately, the per cent. of the total Calories supplied by protein.

⅛ pound cheese at $.30 a pound is $.0375.

8 crackers at $.10 per box containing 22 crackers is $.0364.

Hence the total cost is $.0739, *i.e.*, 450 Calories of crackers and cheese cost $.0739.

Let x represent the number of dollars in the cost of 1000 Calories.

Then $\frac{x}{.0739} = \frac{1000}{450}$

or $x = \$.16$.

Hence, $.16 is the cost of 1000 Calories of crackers and cheese.

The results may be tabulated as on page 150.

The amount of time involved in obtaining the desired data can be lessened by observing the following directions:

(*a*) Enter the name and the quantity of each of the foods.

(*b*) Enter the weight of the given quantity of each of the foods. (It is not necessary to know the weight of certain foods, *e.g.*, eggs, lettuce, etc., in order to determine the number of 100-Calorie portions. After a little practice in the use of the tables the student will know when the weight of a food need not be entered.)

CALCULATION OF FUEL VALUE AND COST OF DIETARY

Number to Serve, 1

Name.....

Meal..... *Date* .....

Cost per lb., qt., etc.	Cost per given quantity	Quantity	Weight in oz.	Food	No. of 100-Calorie portions	Total Calories	Calories yielded by protein in 100-Calorie portion	Calories yielded by protein in given quantity
$.30 per lb.....	$.0375	⅛ lb.	2.0	American pale cheese	2.5	250	26	65
.10 per 22 crackers.	.0364	8	1.8	Soda crackers	2.0	200	10	20
Total cost.....	$.0739	.....	....	Totals.....	....	450	..	85

Per cent. of total Calories derived from protein, 19 per cent.
Cost per 1000 Calories, $.16

(*c*) Refer to the table of 100-Calorie portions and enter, in the proper columns after each food, the number of 100-Calorie portions and the number of protein Calories yielded by a 100-Calorie portion. It is important, in securing efficiency, that these items should be entered for all ingredients before any of the other computations are made.

(*d*) Compute, for each food, the total number of Calories and the number of protein Calories yielded by the given amount.

(*e*) Find the totals of columns 7 and 9.

(*f*) Find the per cent. of the total number of Calories derived from protein.

Find the total number of Calories, the number of Calories derived from protein, the per cent. of the total number of Calories derived from protein, the total cost, and the cost per 1000-Calorie portion of the following combinations of food materials:

1. One slice of bread
   ¼ oz. of butter
2. 2 slices of bread
   1 cup of whole milk
3. 1 shredded wheat
   ½ cup of 18 per cent. cream
4. 10 peanuts
   1 apple
5. Beef sandwich:
   2 slices of bread
   1 pat butter
   1 tbs. of chopped beef
6. Egg sandwich:
   2 slices of bread
   1 pat butter
   ½ egg
7. One glass milk
   Date sandwich:
   2 slices of bread
   1 pat butter
   4 dates
8. Cream tomato soup.
   Crackers

9. Make a simple combination of foods similar to the preceding, and find the total number of Calories, the number of Calories derived from protein, and the per cent. of the total number of Calories derived from protein.

EXERCISE XIX

The fuel value of menus can be computed by the same method as that used in computing the fuel value of combinations of foods.

Problem.—In the following menu, compute:

(1) the total number of Calories;
(2) the average number of Calories per individual;
(3) the total number of Calories yielded by protein;
(4) the per cent. of the total number of Calories derived from protein;
(5) the total cost;
(6) the cost per individual;
(7) the cost per 1000 Calories.

Calculation of Fuel Value and Cost of Menu

Number to Serve, 6

Meal, Dinner *Name*.....

Date.....

Cost per lb., qt., etc.	Cost per given quantity	Quantity	Weight in oz.	Food	No. of 100-Calorie portions	Total Calories	Calories yielded by protein in 100-Calorie portion	Calories yielded by protein in given quantity
$.20 per can.....	$.3000	1½ cans	24	Bouillon	¾	75	84	63
.25 per box.....	.0469	15	....	Crackers, saltines	2½	250	10	25
.45 per lb.....	2.2500	5 lb	80	Chicken	38	3800	33	1254
1.48 per 24½ lb.....	.0094	⅝ c.	2½	Flour	2½	250	13	32
.14 per lb.....	.0700	1 c.	8	Rice	8	800	9	72
.15 per bunch.....	.1500	1 bunch	35	Asparagus	2¼	225	32	72
.10 per loaf.....	.0667	⅔ loaf	11	Bread	8	800	14	112
.48 per lb.....	.1200	4 oz.	4	Butter	8	800	1	8
.15 per qt.....	.0375	1 c.	4	Cranberries	½	50	3	2
.10 per head.....	.1000	1 head	....	Lettuce	½	50	25	12
7.50 per gal.....	.1562	⅓ c.	....	Olive oil	4	400	..	....
.60 per qt.....	.6000	1 qt.	32	Ice cream	16	1600	6	96
.55 per doz.....	.0458	1	....	Egg	¾	75	36	27
.09 ½ per lb.....	.0439	1 c.	7⅞	Sugar, granulated	8	800	..	....
.14 per lb.....	.0197	9 dom's.	....	Sugar, domino	2½	250	..	....
.20 per ½ pt.....	.0750	6 tbs.	4¼	Cream, 40 per ct.	4½	450	2	9
.30 per lb.....	.0035	1½ ts.	....	Baking powder	....	....	..	....
.25 per 2 oz.....	.0139	½ ts.	....	Vanilla	....	....	..	....
.30 per lb.....	.0282	6 tbs.	....	Coffee	....	....	..	....
.15 per 26 oz.....	.0077	⅙ c.	....	Vinegar	....	....	..	....
Total cost.....	$4.1444	.....	....	Total.....	....	10675	..	1784

Calories per individual.....1779
Calories derived from protein per individual..... 297
Per cent. of Calories derived from protein..... 17

Cost per individual.....$.69
Cost per 1000 Calories..... .39

Dinner Menu for Six Persons

Bouillon .....1½ cans
Crackers, saltines 15
Chicken .....5 lbs.
Chicken gravy:
  Chicken stock .....1 cup
  Flour .....2 tbs.
  Water .....1 cup
Rice .....1 cup
Asparagus .....1 bunch
Bread ..... ⅔ loaf
Butter .....4 oz.
Cranberry sauce:
  Cranberries .....1 cup
  Sugar .....½ cup
  Water .....½ cup
Lettuce salad:
  Lettuce .....1 head
  French dressing .....½ cup
Ice cream .....1 qt.
Sponge cake .....½ recipe

Recipe for Sponge Cake.

2 eggs
1 c. sugar
1 c. flour
1½ ts. baking powder
½ ts. vanilla

Cream .....6 tbs.
Coffee .....6 tbs.
Sugar .....9 lumps

The results are tabulated on page 152.

In estimating the fuel value of dietaries it is sometimes desirable to compute the fuel value of each meal in the dietary separately, and then to combine the totals; otherwise the amount of compu-

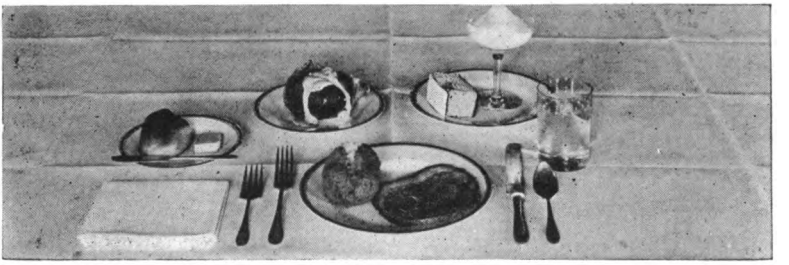

FIG. 33.—A dinner for a woman.

tation is somewhat lessened by computing the fuel value of the entire dietary at the same time, combining all the foods that occur in more than one meal and finding their fuel value as a whole. To illustrate, if butter is served at the table and if it is also used in the preparation of vegetables, it is simpler to find the total fuel value of the butter used than to compute each amount separately. In the same way, if milk is served at each meal and also used in cooking, it is usually simpler to find the fuel value of the total amount for the day than for each recipe and each meal separately.

The recipes in the menus given on pages 154-157 are printed on pages 138 and 172–173. If the fuel value of these recipes has been computed and kept on file, these results can be used in computing the fuel value of the dietaries: if not, the computation will have to be made at this time or other foods substituted.

In each of the following menus and dietaries compute:

(*a*) the total number of Calories per meal or per day;

(*b*) the average number of Calories per individual per meal or per day;

(*c*) the total number of Calories yielded by protein per meal or per day;

(*d*) the per cent. of the total number of Calories derived from protein;

(*e*) the total cost;

(*f*) the cost per individual;

(*g*) the cost per 1000 Calories.

Criticize the results when possible with reference to the per cent. of fuel supplied by protein.

1. Breakfast for 1 person:

Orange	1
Cornflakes	1 oz.
Thin cream	½ cup
Rolls	2
Butter	1 pat
Milk	1 glass

2. Breakfast for 1 person:

Banana	1
Farina	1 oz. dry
Thin cream	¼ cup
Toast	2 slices
Butter	1 pat
Egg	1
Coffee	1 tbs.
Cream	1 tbs.
Sugar	2 ts.

3. Breakfast for a family of 6:

Stewed prunes	½ lb. with juice
Shredded wheat biscuit	6
Whole milk	2 qts.
Bread	½ loaf
Butter	3 oz.
Bacon	12 slices
Eggs	6

4. Lunch for family of 6:

Peas, green	1 qt.
Milk	¼ cup
Cream of salmon on toast	
Salmon	½ lb.
Cream sauce	1 cup
Toast	6 slices
Graham bread	12 slices
Butter	6 oz.
Peaches	6

5. Lunch for 2 girls:

Eggs	3
Bread	6 slices
Butter	2 oz.
Spinach, boiled, chopped	1 pt.
Milk	2 glasses
Plain cake	2 pieces

6. Lunch for a school girl:

Cream of pea soup	
Peas	¼ can
Sugar	½ ts.
Water	⅓ cup
Milk	½ cup
Butter	½ tbs.
Flour	½ tbs.
Toast	2 slices
Butter	1 tbs.
Baked apple	1
Cookies, plain	2

7. Dinner for a woman (Fig. 33, page 153):

Cold roast beef	3 oz.
Potato	1
Tomato salad	
Tomato	1
Mayonnaise dressing	1 tbs.
Lettuce	2 leaves
Roll	1
Butter	1 tbs.
Ice cream	¾ cup
Sponge cake	1 piece

8. Lunch for 4 girls:

Lamb chops	4
Baked potatoes	4
Bread	8 slices
Butter	8 tbs.
Bananas and oranges sliced	
Bananas	2
Oranges	2
Sugar	2 ts.
Cookies, plain	8

9. Lunch for 3 children:

Milk toast	
Milk	3 cups
Toast	6 slices
Stewed prunes	½ lb. (dried)
Barley sponge cake	3 pieces

10. Dinner for 6 adults:

Tomato soup	
Tomatoes, canned	1 cup
Milk	1 qt.
Flour	2 tbs.
Salt	2 ts.
Soda	½ tbs.
Butter	2 tbs.
Mutton, leg	3 lbs.
Mashed potatoes	6
Bread	½ loaf
Butter	4 oz.
String beans	1 qt.
Cabbage salad	
Cabbage	¼ head
Salt	½ ts.
Mustard	½ ts.
Cayenne	spk.
Sugar	1 ts.
Egg	1
Milk	½ cup
Butter	2 ts.
Vinegar	¼ cup
Lemon Jelly	
Gelatin	2 tbs.
Water	2½ cups
Sugar	1 cup
Lemons	2
Thick cream	1 cup
Coffee	3 tbs.
Sugar	6 lumps

11. Supper for 2 adults and 3 children:

Cheese soufflé	
Cheese	¼ lb.
Eggs	4
Cream sauce	1½ cups
Riced potatoes	5
Bread	12 slices
Butter	8 pats
Cake, plain	5 slices
Baked apples	5

Decide upon the amount of each kind of food to be served in the following menus, and then compute the fuel value as above:

12. Dinner for a child 5 years old:

Bread
Butter
Creamed potatoes
Green peas (fresh)
Prunes
Milk

13. Dinner for a salesman's family of 2 adults and a child 8 years old:

Roast beef
Creamed macaroni
1 cup macaroni
1 cup cream sauce
Bread and butter
Spinach
Celery and nut salad with French dressing
Ice cream

14. Dinner for a machinist's family of 2 adults and 3 children:

Roast pork
Mashed potatoes and gravy
Bread and butter
Creamed carrots
Cabbage salad
Apple pie
Cheese

15. Make an accurate list of the amount and kind of food served in your home for breakfast and compute the fuel value of the meal as above.

16. Dietary for a child 2–4 years old:[11]

Breakfast: 7.30 A.M.

Oatmeal mush	0.8 ounce dry cereal
Milk	1½ cups
Stale bread	1 slice
Orange juice	4 tbs. (33 Calories)

Lunch: 11 A.M.

Milk	1 cup
Stale bread	1 slice
Butter	1 ts.

[11] Adapted from child's dietary in *The Feeding of Young Children*, by Mary Swartz Rose. Used by permission of and special arrangement with the Macmillan Company, Publishers.

Dinner: 1 P.M.

Baked potato	1
Boiled onion (mashed)	1
Bread and butter	1 slice
Milk to drink	1 cup
Baked apple	1

Supper: 5.30 P.M.

Boiled rice	4 tbs., dry
Milk	¾ cup
Bread and butter	1 slice

17. Dietary for a business man of average weight arranged to agree with the Atwater dietary standards.[12]

Breakfast.

	Weight of food in ounces
Bananas	3.5
Oatmeal (weighed dry)	1.0
Sugar	1.0
Cream	2.0
Eggs, 2	3.5
Toast	2.0
Roll	1.0
Butter	0.5

Luncheon.

Bluefish[13]	4.0
Potato	4.2
Rolls	2.0
Butter	1.0
Milk	5.0
Apple pie	4.0

Dinner.

Steak	4.0
Potatoes	4.0
Corn, canned	3.5
Celery	4.0
Bread	2.0
Butter	1.0
Baked apple	5.5
Cream	4.0

[12] *The Chemistry of Food and Nutrition*, by H. C. Sherman, p. 211. Used by permission of and special arrangement with the Macmillan Company, Publishers.

[13] Four oz. of bluefish yield 100 Calories, of which 88 are derived from protein.

18. Dietary for a family of 2 adults and 4 children.[14]

Breakfast.

	Food	Amount
Rolled oats	Rolled oats	2 cups
Milk and sugar	Milk	1 qt.
Bread and butter	Sugar	½ lb.
Coffee	Bread	1½ lbs.
Cocoa shells (for children)[15]	Oleomargarine	4 oz.
	Coffee	½ oz.

Dinner.

Meat balls	Meat (round of beef)	1 lb.
Rice with brown gravy	Rice	1½ lbs.
Boiled onions	Onions	1 lb.
Bread and butter	Flour	3 cups
Sliced bananas with lemon juice	Lemon	1
	Bananas	6
	Tea	1 oz.

Supper.

Baking powder biscuits
Sugar syrup
Tea with lemon

19. The following dietary for a family of five, consisting of father, mother, and three children between five and fourteen years of age, was proposed as a minimum for the maintenance of health. Compute the fuel value, the per cent. of fuel derived from protein, and the cost per 100-Calorie portion, and discuss in relation to dietary standards and local prices:[16]

1 pound of cereal, cornmeal, oatmeal	$.03
1 pound of sugar	.08
2¼ pounds of bread, 3 loaves, day old	.09
⅓ pound of molasses	.02
½ pound of oleomargarine	.11
2 quarts of milk	.12
Total	$.45

[14] Taken from *Lessons in the Proper Feeding of the Family*, by Winifred S. Gibbs, Association for Improving the Condition of the Poor, New York.

[15] The nutritive value of cocoa shells may be considered negligible.

[16] This dietary and the substitutions were suggested by Dr. Haven Emerson, Commissioner of Health, New York, in a speech to a group of cloak-makers out of work on account of a strike. His estimate of the total cost was 45 cents; of the total Calories, 10,000. (From report in *New York Times*, July, 1916.)

20. Make the following substitutions in the preceding dietary and discuss the alteration in cost, in fuel value, the per cent. of the fuel derived from protein, and the cost per 100-Calorie portion.

"If 20 cents more a day can be spared, it should be spent for 10 cents' worth of potatoes and 10 cents' worth of apples. One-half pound of pork fat, costing 10 cents, may be substituted for the oleomargarine."

Economy in Planning Meals

The cost of a dietary can frequently be lessened without altering its total fuel value by substituting in place of the more expensive foods in the dietary, the amount of a cheaper food that will yield an equivalent fuel value.

EXERCISE XX

Problem.—How many pounds of dried beans will have the same fuel value as one pound of mutton chops? If dried beans cost $.14 per pound and mutton chops $.35 per pound, find the actual saving in buying the cheaper food.

Dried beans and mutton chops have fuel values of 1520 and 1415 Calories per pound respectively.

Let x = the required number of pounds of dried beans.

Then $\frac{1520}{1415} = \frac{1}{x}$

and $x = .93$.

That is, .93 pounds of dried beans will have the same fuel value as 1 pound of mutton chops.

$.93 \times \$.14 = \$.1302$ or $.13, the cost of the dried beans.

$\$.35 - \$.13 = \$.22$, the saving in buying beans.

Hence, $.13 worth of dried beans have fuel value equivalent to $.35 worth of mutton chops.

1. How many pounds of American pale cheese will have the same fuel value as 2 lbs. of sirloin steak? Find the difference in cost.

2. If peanuts are substituted for 2 lbs. of round steak, how many pounds must be bought to produce the same number of Calories? Find the actual saving in using peanuts.

3. How many pounds of halibut steak will it take to yield the same number of Calories as 11 lbs. of round steak? Find the actual difference in cost if halibut is substituted for 11 lbs. of round steak.

4. If halibut is substituted for 11 lbs. of sirloin steak, how much must be bought? What is the difference in cost?

5. If porterhouse steak is bought in place of 3 lbs. of round steak, how many pounds must be bought in order to obtain the same number of Calories? Find the actual difference in cost.

6. How many pounds of rib roast beef will it take to equal 1 dozen eggs in fuel value? Compare the cost if roast beef costs 35 cents a pound and eggs cost 40 cents a dozen; 55 cents a dozen; 60 cents a dozen; 80 cents a dozen.

7. At the current local prices, which is the more expensive source of fuel, roast beef or eggs?

8. How much sweet chocolate will it take to yield as many Calories as a 10-cent box of soda crackers and ⅛ lb. cheese? What is the difference in cost?

9. Select from the table of 100-Calorie portions five foods in which approximately the same number of Calories is supplied by protein and compare the cost of these foods per 100-Calorie portion.

10. Select a food in which approximately the same number of Calories is supplied by protein per 100-Calorie portion as in lamb chops and substitute it in the luncheon menu 8, page 155, to cheapen the cost of the meal.

11. Make a similar substitution for leg of mutton in the dinner menu 10 on page 156.

12. In the lunch for the family of six, example 4, page 155, substitute for butter, oleomargarine; and for cream of salmon on toast, 6 oz. of pearl hominy baked with 2 oz. of cheese. (The fuel value of hominy is 1650 Calories per pound.) Does this substitution reduce the cost?

13. In the dinner menu on page 153 make the following substitutions for the purpose of reducing the cost: Cottonseed table oil in place of olive oil; oleomargarine in place of butter; fish in place of chicken. Also reduce the number of Calories per individual to 1400.

14. Modify the dinner menu, example 13, page 157, so that it is a meatless, wheatless, butterless meal. Use cottonseed table oil in place of olive oil.

15. Alter dietary 17, page 158, for a vegetarian (*i.e.*, a person who does not eat meat or fish).

16. Alter dietary 18, page 159, in a similar way for a vegetarian.

17. What other substitutions would you suggest to lessen the cost of any of these menus or dietaries or to lessen the amount of meat or wheat used?

Minerals in Food Materials

In order to plan dietaries which will meet all the needs of the body it is necessary to know what minerals are required and also what foods furnish them. While there are eleven minerals which

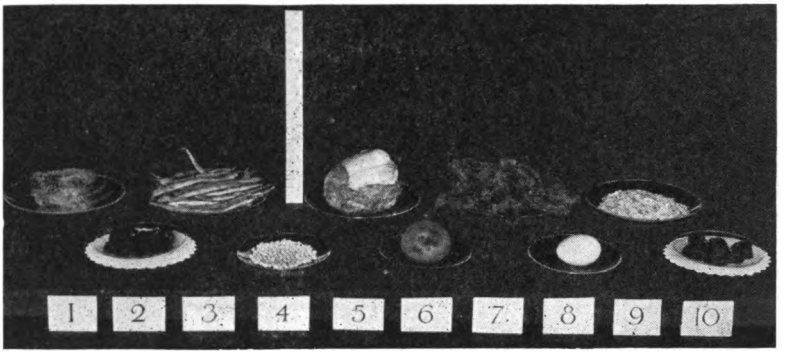

Fig. 34.—**Quantities of food containing two milligrams of iron.** (15 milligrams is the daily requirement.) **1.** Graham bread, 2.8 oz., 3 slices 3″ x 3½″ x ½″; **2.** Dates, 2.3 oz., 10 dates; **3.** String beans, 6.4 oz., 30 to 36 6″ beans; **4.** Navy beans, 1.0 oz., 2 tbs.; **5.** Lettuce, 10.1 oz., 1 solid head 4″ x 5″; **6.** Potato, 5.3 oz., 1 medium; **7.** Spinach, 2.0 oz., 2 c.; **8.** Egg, 2.3 oz., 1 very large; **9.** Rolled oats, 1.8 oz., ⅔ c.; **10.** Prunes, 2.3 oz., 6 medium (size 40-50).

enter into the composition of the body, it is probable that if the diet is so selected as to furnish an ample amount of some of the most important of these or of those in which the diet is often found to be deficient, that the supply of other minerals will be sufficient. A study of the food habits of people in this country

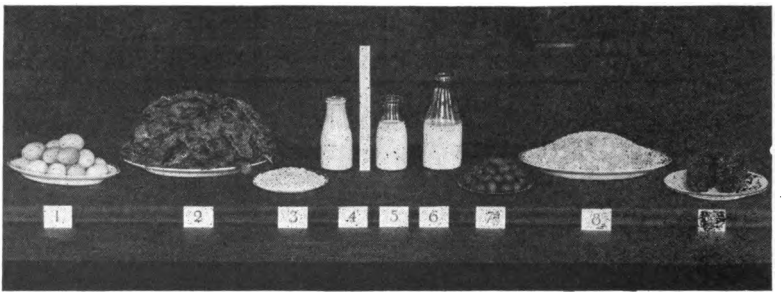

Fig. 35.—**Quantities of food containing as much calcium as 1 pint of milk.** 1 pint whole milk contains .58 g. of calcium. The daily requirement is .67 g. "The most practical means of insuring an abundance of calcium in the dietary is to use milk freely as food." *Sherman's Chemistry of Food and Nutrition*, 1917, p. 268. **1.** Eggs, 30.4 oz., 14; **2.** Spinach, 30.4 oz., ⅔ peck; **3.** Navy beans, 12.8 oz., 2 c.; **4.** Whole milk, 17.0 oz., 1 pt.; **5.** Skimmed milk, 16.7 oz., 1¼ c.; **6.** Cream, 23.7 oz., 2¼ c.; **7.** Olives, 16.7 oz., 1½ pts.; **8.** Rolled Oats, 29.5 oz., 3 qts.; **9.** Raisins, 31.9 oz., 2 1-lb. packages.

has revealed the fact that many dietaries which are satisfactory, as far as the fuel value and the protein requirement are concerned, are deficient in phosphorus, calcium, or iron. Of these mineral substances calcium and phosphorus are required in relatively large amounts compared with other minerals, while the requirement for iron is relatively small, but it is none the less important (Figs. 33 and 34).

An adequate allowance of each of these three minerals per man per day, as determined by experiments, is as follows:[17]

Phosphorus	1.44 grams
Calcium	.67 grams
Iron	.015 grams or 15 milligrams

Minerals are found in all the natural foods, such as milk, eggs, vegetables, nuts, meat, etc., but these foods vary in importance as sources of the different minerals, as will be seen by the following table:

ASH CONSTITUENTS OF FOODS IN PERCENTAGE OF THE EDIBLE PORTION[17]

Food	Phosphorus	Calcium	Iron
Beef, all lean	.218	.007	.0039
Bluefish	.211	.023	....
Eggs	.180	.067	.0030
Egg yolk	.524	.137	.0086
Butter	.018	.014	....
Cheese	.683	.931	.0013
Cream	.067	.086	.0002
Milk	.093	.120	.0002
Milk, skimmed	.096	.122	....
Bread, graham	.218	.05	.003
Bread, white	.088	.021	.0009
Flour, white	.092	.020	.0010
Oatmeal	.392	.069	.0038
Rice, polished	.096	.009	.0009
Wheat, entire grain	.423	.045	.0050
Beans, dried	.471	.160	.0070
Beans, string	.052	.046	.001
Beets	.039	.029	.0006
Cabbage	.029	.045	.0011
Carrots	.046	.056	.0006
Corn, sweet, fresh	.103	.006	.0008
Lettuce	.042	.043	.0007
Onions	.045	.034	.0006
Potatoes	.058	.014	.0013
Spinach	.068	.067	.0036

[17] *Chemistry of Food and Nutrition.* H. C. Sherman. 1917. Used by permission of and special arrangement with the Macmillan Company, Publishers.

ASH CONSTITUENTS OF FOODS IN PERCENTAGE OF THE EDIBLE PORTION (CONTINUED)

Food	Phosphorus	Calcium	Iron
Turnips	.046	.064	.0005
Apples	.012	.007	.0003
Bananas	.031	.009	.0006
Lemons	.022	.036	.0006
Olives	.014	.122	.033
Oranges	.021	.045	.0002
Prunes, dried	.105	.054	.0030
Dates	.056	.065	.003
Raisins	.132	.064	.002
Almonds	.465	.239	.0039
Peanuts	.399	.071	.0020
Walnuts	.357	.089	.0021

EXERCISE XXI

Problem.—How many grams of iron are furnished by ½ pound of dried beans? ½ lb. = 8 oz.

According to the table on page 163, .007 per cent. of the edible portion of dried beans is iron.

Hence, .00007 × 8 oz., or .00056 oz., of iron are furnished by 8 oz. of dried beans; that is, .00056 × 28.35 gm., or .0159 gm., of iron are furnished by ½ lb. of beans [1 oz. = 28.35 g.].

1. Find the number of grams of phosphorus, of calcium, and of iron which are furnished by each of the following:

1 glass of milk
1 head of cabbage, weighing 4 lbs.
1 peck of spinach, weighing 3 lbs.
1 egg, weighing 2 oz.
½ lb. cheese
1 lb. beef
¼ lb. almonds

2. Find the total number of grams of phosphorus, of calcium, and of iron furnished by the foods in the following breakfast menu:

Food	Quantity	Food	Quantity
Orange	7 oz.	Oatmeal	1 oz.
Bread	4 oz.	Milk	8 oz.
Butter	½ oz.	Sugar	¼ oz.

3. Make out a list of five foods, specifying the amount of each, which if combined in a day's dietary with other foods poor in iron, would furnish an ample supply of iron for one person.

4. Make out a list of five foods, specifying the amount of each, which if combined in a day's dietary with other foods poor in calcium, would furnish an ample supply of calcium for a family of five.

5. Make out a list of five foods, specifying the amount of each, which if combined with other foods poor in phosphorus, would furnish an ample supply of phosphorus for two adults.

6. Compute the calcium, iron, and phosphorus content of the foods in the dietary in example 17, page 158.

7. Compute the calcium, iron, and phosphorus content of the foods in the dietary in example 18, page 159.

8. Criticize with respect to the amount of iron, of calcium, and of phosphorus any of the dietaries you have made.

9. Criticize your own dietary for one day with respect to the amount of iron, of calcium, and of phosphorus.

EXERCISE XXII

Problem.—Illustrate graphically the amount of iron furnished by one dollar's worth of each of the following foods: Bread, carrots, eggs, lettuce, milk, oatmeal, potatoes, prunes, spinach.

Food	Price	No. of oz. for $1.00	Oz. of iron furnished by $1.00	Milligrams of iron furnished by $1.00
Bread	$.10 per 16 oz. loaf	160	.00144	41
Carrots	.05 per 10 oz. bunch	200	.00120	34
Eggs	.55 per doz. 27 oz.	49	.00147	42
Lettuce	.10 per 9 oz. head	90	.00063	18
Spinach	.15 per peck, 3 lb.	320	.01152	327
Milk	.14 per qt. 32 oz.	229	.00046	13
Oatmeal	.13 per box of 20 oz.	154	.00585	166
Potatoes	1.30 per 30 lb.	369	.00480	136
Prunes	.15 per lb.	107	.00321	91

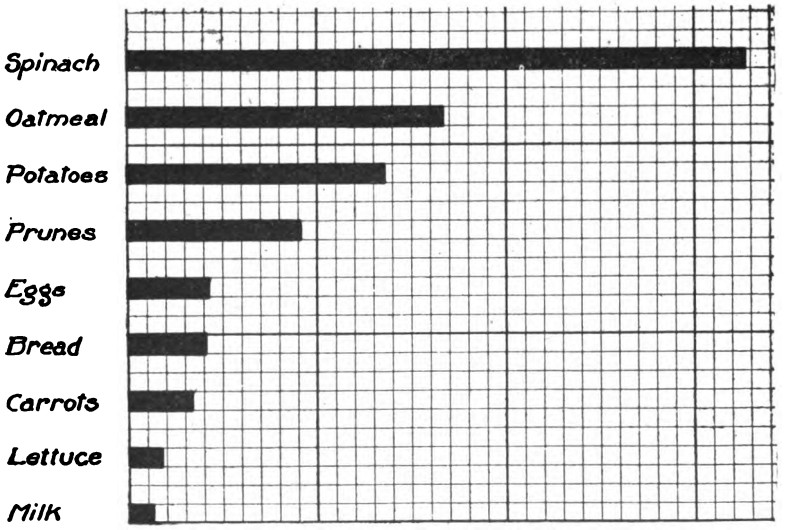

FIG. 36.—Milligrams of iron furnished by one dollar's worth of each of the above foods.

1. Illustrate graphically the amount of calcium furnished by one dollar's worth of each of the foods in the preceding problem.

2. Illustrate graphically the amount of phosphorus furnished by one dollar's worth of each of these foods.

3. What foods are comparatively economical sources of iron? Of calcium? Of phosphorus?

EXERCISE XXIII

In planning the following menus and dietaries care should be taken to see that such foods are included as will insure a sufficient amount of calcium, iron, and other minerals, as well as of vitamines.

1. At a cost not to exceed 15 cents, plan a breakfast for yourself containing about 800 Calories.

2. At a total cost not to exceed $1, plan a dinner for a family of 5 persons whose total daily fuel requirement is 10,500 Calories.

3. At a total cost of not more than 30 cents, plan a lunch for two boys of 16 and 17 years of age. The meal should contain about one-third of the total fuel requirement for the day.

4. At a cost not to exceed 40 cents, plan a day's dietary for yourself.

5. At a cost not to exceed $1.50, plan a day's dietary for a professional man, his wife, and two children of 10 and 14 years respectively.

6. At a cost not to exceed 42 cents per individual, plan a day's dietary for your own family.

7. Plan a day's dietary for 5 girls on a camping trip.

8. Plan a day's dietary for yourself at a cost not to exceed 10 cents per 1000 Calories.

9. Find out the lowest sum for which a suitable dietary for a typical workingman's family of five could be obtained in your locality.

Chemical Composition of Foodstuffs

In the scientific study of nutrients, it is necessary to base the computation of the fuel value of dietaries upon the percentage composition of food materials.

EXERCISE XXIV

Problems in the use of the table of Chemical Composition of Common American Food Products, Table A, page 175.

1. Compare the per cent. of protein yielded by the following foodstuffs: Loin of beef, leg of lamb, eggs, oatmeal, dried beans.

2. Select from the table five foods that contain a large per cent. of protein; five that contain a large per cent. of fat; five that contain a large per cent. of carbohydrates.

3. Select five vegetables that contain a relatively large per cent. of mineral ash.

4. Represent graphically the relative per cent. of carbohydrates in the following foods: Sugar (granulated), flour, potatoes, honey, oatmeal.

5. Represent graphically the relative per cent. of water in the following foods: Milk (whole), butter, watermelon, tomatoes, grapes, strawberries, wheat flour (white).

6. Represent graphically the relative per cent. of refuse in the following foods: Porterhouse steak, eggs, green beans, almonds, potatoes, bananas, celery, watermelon.

7. Using three different colors, each color to represent one of the three groups of nutrients, protein, fat, and carbohydrates, illustrate graphically the per cent. of each of these nutrients in the following food materials:[18] Leg of lamb, halibut steak, chicken, American pale cheese, bananas, sweet potatoes, peanuts, sugar, butter.

Determination of the Fuel Value of Foods

The fuel value of foods has been determined by measuring the amount of heat that is produced when these food materials are burned. It may be computed from the table of their chemical composition by determining the weight of each of the energy-producing nutrients in the food material. The amount of heat that will be produced by any food material depends upon the weight of the protein, the fat, and the carbohydrates it contains.

Protein yields 4 Calories per gram, or 113 per ounce.

Fat yields 9 Calories per gram, or 255 per ounce.

Carbohydrates yield 4 Calories per gram, or 113 per ounce.

[18] The colors used in the charts prepared by the U. S. Department of Agriculture are as follows: Protein, red; fats, yellow; carbohydrates, light blue.

EXERCISE XXV

One ounce equals (approximately) 28.35 grams.

Problem.—Find the fuel value of American cheese per ounce and per pound.

From Table A, page 175, the chemical composition of cheese is: 27.7 per cent. protein, 36.8 per cent. fat, 4.1 per cent. carbohydrates.
Then one ounce of cheese contains:
27.7 per cent. of 1 ounce, or .277 oz. of protein.
36.8 per cent. of 1 ounce, or .368 oz. of fat.
4.1 per cent. of 1 ounce, or .041 oz. of carbohydrates.
The amount of heat that may be produced by one ounce of cheese is:
.277 × 113, or 31 Calories, from the protein.
.368 × 255, or 94 Calories, from the fat.
.041 × 113, or 5 Calories, from the carbohydrates.
The total fuel value of one ounce of cheese is 129 Calories.
The fuel value of one pound of cheese is 16 × 129, or 2064 Calories.[19]
The results may be tabulated as follows:

CALCULATION OF FUEL VALUE OF FOOD

Name.....
Date.....

Name of food	Weight		Protein		Fat		Carbohydrates		Total Calories	
	gm.	oz.	oz.	Cal.	oz.	Cal.	oz.	Cal.	per oz.	per lb.
Cheese.....	28.35	1	.277	31.	.368	94	.041	5	129	2064
Rice.....	28.35	1	.08	9.	.033	.8	.79	89.1	99	1584

Find the number of Calories produced by each class of energy-yielding nutrients and the total Calories per oz. and per lb. of the following foods and tabulate the results, using the above form.

1. Apples
2. Bananas
3. Beef, round
4. Bread
5. Butter
6. Cheese, American pale
7. Cheese, full cream
8. Cocoa
9. Coffee
10. Cornmeal
11. Cream of wheat
12. Cream
13. Eggs
14. Flour, white
15. Flour, entire
16. Flour, graham

[19] This figure is slightly less than that given in the table on page 175 in the column headed "Fuel value per pound." The discrepancy between the two figures is due in part to the fact that the figures in the government bulletin are based on earlier and somewhat higher estimates of the fuel value of foods than seem to have been justified by later experiments.

17. Lard (100 per cent. fat)
18. Milk, whole
19. Oats, rolled
20. Olive oil (100 per cent. fat)
21. Peas, dried
22. Rice
23. Sugar, brown
24. Sugar, granulated
25. Wheatena

EXERCISE XXVI

Data in regard to food are so frequently stated in terms of grams that the student should become sufficiently familiar with the metric system to understand the meaning of the terms, and to convert the weights readily from the metric to the English system and *vice versa*. Use of the metric system simplifies many of the operations involved in dietary computation, and should be encouraged as far as possible.

1 gram = 0.0353 oz.

See Table of Equivalent Measures, Table E, page 190.

Find the weight in ounces of the following foods:

1. 1 large banana which weighs 156 grams.
2. 1 cup orange juice which weighs 231 grams.
3. 4 dates which weigh 32 grams.
4. 1 shredded wheat biscuit which weighs 27 grams.
5. 24 prunes which weigh 235 grams.
6. 1 cup of dried Lima beans which weighs 156 grams.
7. 1 square of unsweetened chocolate which weighs 28 grams.
8. 1 tbs. of cocoa which weighs 8 grams.
9. 1 tbs. of butter which weighs 14 grams.
10. 1 egg which weighs 71 grams.
11. 1 tbs. of wheat flour which weighs 7 grams.
12. 1 tbs. of olive oil which weighs 11 grams.
13. 1 tbs. of brown sugar which weighs 9 grams.

EXERCISE XXVII

Express the approximate weights of the following in ounces and convert to grams:

1. 1 shredded wheat biscuit (weight 1 oz.)
2. 1 tbs. butter
3. 1 ts. sugar
4. ¼ cup butter
5. 2¼ oz. beef
6. 1 banana
7. 1 potato
8. 2 eggs
9. ½ cup rice
10. 2 tbs. flour
11. 1 slice bread, weighing 1.3 oz.
12. 2 graham crackers, each weighing 4 oz.

EXERCISE XXVIII

Problem.—Find the weight in grams of the protein, the fat, and the carbohydrates yielded by 1 gram of milk.

The composition of cow's milk is as follows:

Protein, 3.3 per cent.; fat, 4 per cent.; carbohydrates, 5 per cent.

In one gram of milk there will be by weight:

Protein, .033 gram; fat, .04 gram; carbohydrate, .05 gram.

Find the weight in grams of the protein, the fat, and the carbohydrate in one gram of each of the following: (See Table of Average Composition of American Food Products, page 175.)

1. White bread
2. Mutton chops
3. Halibut steak
4. Cheese
5. Eggs
6. Oatmeal
7. Cream

EXERCISE XXIX

Find the number of Calories yielded by each class of energy-yielding nutrients and the total number of Calories yielded by 1 gram each of the foods in Exercise XXV, page 168, and tabulate the results.

The number of Calories yielded by 1 gram of each of the three classes of energy-yielding nutrients is given on page 167.

Fuel Value of Recipes, Menus, and Dietaries

Computed from the Table of Chemical Composition of Food Materials

The fuel value of combinations of food materials in recipes, menus, and dietaries can be computed from the Table of the Chemical Composition of Food Materials. This method makes it possible to compute the fuel value of foods if the chemical composition is known. The amount of protein in the diet may be stated either in terms of weight or in terms of Calories.

The labor involved in the computations can be somewhat lessened and the results can be made more useful if the data are tabulated and kept for reference.

EXERCISE XXX

Problem.—The following recipe for plain muffins makes 12 muffins to serve 6 persons:

1 cup flour
1 egg
1¼ cups milk (skimmed)
1 tbs. sugar
1 tbs. butter

(1) Find the fuel value and the number of Calories yielded by protein.

(2) What part of the recipe forms a 100-Calorie portion, and how many Calories in this portion are yielded by protein?

(3) Find the number of Calories yielded by protein and the total number of Calories in one muffin.

(4) Find the cost of the recipe, the cost per 1000 Calories, and the cost of one muffin.

The whole recipe yields 1130 Calories.

Let x represent the part of the recipe that forms a 100-Calorie portion.

$$\frac{1130}{100} = \frac{1}{x}$$

That is, $x = .09$ approximately, or $\frac{1}{11}$ of the whole recipe, forms a 100-Calorie portion.

The total number of Calories derived from protein is 170.

Then $.09 \times 170 = 15.30$ or 15 Calories in a 100-Calorie portion are derived from protein.

One muffin, or $\frac{1}{12}$ of the recipe, yields $\frac{1}{12}$ of 1130 Calories, or 94 Calories. The number of Calories produced by protein in one muffin is $\frac{1}{12}$ of 170, or 14 + ; *i.e.*, 14 Calories.

Calculation of Fuel Value of Recipe

Name .....

Date .....

Recipe for plain muffins — Number of muffins.....12

Cost per qt., lb., etc.	Cost per given wt.	Ingredients	Quantity	Weight in oz.	Calories yielded by 1 oz.	Total Calories yielded by given weight	Calories yielded by protein in 1 oz.	Calories yielded by protein in given weight
$1.48 per 24½ lb.	.0302	Flour	2 c.	8.	100	800	13	104
.55 per doz...	.0458	Egg	1	1.7	38	65	15	26
.05 per qt....	.0156	Milk, skimmed	1¼ c.	10.	10	100	4	40
.09½ per lb...	.0297	Sugar	1 tbs.	.5	113	56	....	....
.48 per lb....	.0150	Butter	1 tbs.	.5	218	109	1	....
.30 per lb....	.0047	Baking powder	2 ts.	....	....	....	....	....
		Salt	¼ ts.	....	....	....	....	....
Total cost....	.1410	Total				1130		170

Calories yielded by 1 muffin.... 94
Calories derived from protein in 1 muffin 14
Calories derived from protein in 100-Calorie portion 15
Cost per muffin..... $.0118
Cost per 1000 Calories ..... .127

Using forms similar to those on page 171, compute for each of the following: [20]

(*a*) The fuel value and the number of Calories yielded by protein.

(*b*) The number of Calories yielded by protein and the total number of Calories in one serving.

(*c*) The total cost of the recipe, the cost per 1000 Calories and the cost of one serving.

1. Stewed prunes.

2 c. dried prunes (protein 2.1 per cent., carbohydrates 73.3 per cent.)
¼ c. sugar
1 ts. lemon juice

12 servings.

2. Baked apples.

6 apples
6 ts. sugar
6 tbs. water

6 servings.

3. White sauce for creamed vegetables.

2 tbs. flour
2 tbs. butter
1 c. milk
Salt and pepper

6 servings.

4. Home-made ice cream.

2 c. milk (whole)
2 c. cream
1 c. sugar
2 tbs. flour
2 eggs
1 tbs. vanilla

Ice Cream increases in quantity one-third to one-half in freezing.

16 servings.

5. Cheese fondu.

1 c. bread crumbs (3 oz.)
1 c. milk
¾ c. grated cheese (3 oz.)
1 egg
1 tbs. butter
Salt and cayenne pepper

6 servings.

[20] Unless otherwise specified, skimmed-milk is used in all recipes.

6. French dressing.

¼ ts. salt
⅛ ts. pepper
3 tbs. olive oil
1 tbs. vinegar
3 servings.

7. Meat croquettes.

2 c. chopped meat
½ ts. salt and ⅛ pk. pepper
Few drops onion juice
1 egg yolk
⅔ c. of white sauce
8 croquettes

8. Baking powder biscuits

2 c. flour
4 ts. baking powder
½ ts. salt
1½ tbs. shortening (lard)
¾ c. milk
16 small biscuits

9. Bread pudding.

1 c. bread crumbs (3 oz.)
1½ c. milk
1 egg
1 tbs. sugar.
1 tbs. butter
6 servings.

10. Rolls.

2 c. milk
3 tbs. butter
2 tbs. sugar
1 ts. salt
1 yeast cake
3 c. flour
24 rolls

11. Creamed peanuts and rice.

1 c. rice
1 c. peanuts
½ ts. paprika
2 ts. salt
3 c. white sauce
12 servings.

12. Sugar cookies.

4 oz. fat
1 c. sugar
1 egg
½ c. milk
2 ts. baking powder
2 c. flour
1 ts. flavoring or spice
40 cookies

13. School lunch for a girl 14 years old.

2 chopped-egg sandwiches
4 slices bread
1 pat butter
1 egg
1 orange
2 sugar cookies

14. Lunch for 3 women.

Pea soup	¾ can peas 6 ts. sugar 3 c. milk 3 tbs. butter 3 tbs. flour
Crackers	6 crackers
Macaroni and cheese	3 tbs. cheese ¾ c. macaroni
Graham bread and butter	3 slices of bread 3 pats of butter
Tea and cookies	2 ts. tea 3 cookies

15. Supper for a family of 5, a clerk, his wife, and 3 children under 12 years.

Cheese soufflé	4 tbs. cheese 3 eggs 1½ cups milk 1½ tbs. flour
Riced potatoes	6 potatoes
Bread and butter	6 oz. bread 3 oz. butter
Doughnuts	5 doughnuts
Baked apples	5 apples 10 tbs. sugar

16. Dinner for a family of 6, a teamster, his wife, and 4 children under 16 years.

Leg of mutton and gravy Mashed potatoes	3 lb. mutton 2 tbs. flour 2 lb. potatoes ¼ c. milk
Creamed carrots	1½ lb. carrots 1 recipe white sauce
Bread and butter	6 tbs. of butter ½ loaf of bread
Apple pie	1½ pies

17. Your own breakfast.

TABLE A

Average Composition of Common American Food Products[21]

Food materials (as purchased).	Refuse	Water	Protein	Fat	Carbohydrates	Ash	Fuel value per pound
ANIMAL FOOD							
Beef, fresh:	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Calories.*
Chuckribs	16.3	52.6	15.5	15.0	.....	0.8	910
Flank	10.2	54.0	17.0	19.0	.....	.7	1,105
Loin	13.3	52.5	16.1	17.5	.....	.9	1,025
Porterhouse steak	12.7	52.4	19.1	17.9	.....	.8	1,100
Sirloin steak	12.8	54.0	16.5	16.1	.....	.9	975
Neck	27.6	45.9	14.5	11.9	.....	.7	1,165
Ribs	20.8	43.8	13.9	21.2	.....	.7	1,135
Rib rolls	.....	63.9	19.3	16.7	.....	.9	1,055
Round	7.2	60.7	19.0	12.8	.....	1.0	890
Rump	20.7	45.0	13.8	20.2	.....	.7	1,090
Shank, fore	36.9	42.9	12.8	7.3	.....	.6	545
Shoulder and clod	16.4	56.8	16.4	9.8	.....	.9	715
Fore quarter	18.7	49.1	14.5	17.5	.....	.7	995
Hind quarter	15.7	50.4	15.4	18.3	.....	.7	1,045
Beef, corned, canned, pickled, and dried:							
Corned beef	8.4	49.2	14.3	23.8	.....	4.6	1,245
Tongue pickled,	6.0	58.9	11.9	19.2	.....	4.3	1,010
Dried, salted, and smoked	4.7	53.7	26.4	6.9	.....	8.9	790
Canned boiled beef	.....	51.8	25.5	22.5	.....	1.3	1,410
Canned corned beef	.....	51.8	26.3	18.7	.....	4.0	1,270
Veal:							
Breast	21.3	52.0	15.4	11.0	.....	.8	745
Leg	14.2	60.1	15.5	7.9	.....	.9	625
Leg cutlets	3.4	68.3	20.1	7.5	.....	1.0	695
Fore quarter	24.5	54.2	15.1	6.0	.....	.7	535
Hind quarter	20.7	56.2	16.2	6.6	.....	.8	580
Mutton:							
Flank	9.9	39.0	13.8	36.9	.....	.6	1,770
Leg, hind	18.4	51.2	15.1	14.7	.....	.8	890
Loin chops	16.0	42.0	13.5	28.3	.....	.7	1,415
Fore quarter	21.2	41.6	12.3	24.5	.....	.7	1,235
Hind quarter, without tallow	17.2	45.4	13.8	23.2	.....	.7	1,210
Lamb:							
Breast	19.1	45.5	15.4	19.1	.....	.8	1,075
Leg, hind	17.4	52.9	15.9	13.6	.....	.9	860
Pork, fresh:							
Ham	10.7	48.0	13.5	25.9	.....	.8	1,320
Loin chops	19.7	41.8	13.4	24.2	.....	.8	1,245
Shoulder	12.4	44.9	12.0	29.8	.....	.7	1,450
Tenderloin	.....	66.5	18.9	13.0	.....	1.0	895
Pork, salted, cured, and pickled:							
Ham, smoked	13.6	34.8	14.2	33.4	.....	4.2	1,635
Shoulder, smoked	18.2	36.8	13.0	26.6	.....	5.5	1,335
Salt pork	.....	7.9	1.9	86.2	.....	3.9	3,555
Bacon, smoked	7.7	17.4	9.1	62.2	.....	4.1	2,715
Sausage:							
Bologna	3.3	55.2	18.2	19.7	.....	3.8	1,155
Pork	.....	39.8	13.0	44.2	1.1	2.2	2,075
Frankfort	.....	57.2	19.6	18.6	1.1	3.4	1,155
Soups:							
Celery, cream of	.....	88.6	2.1	2.8	5.0	1.5	235
Beef	.....	92.9	4.4	.4	1.1	1.2	120
Meat stew	.....	84.5	4.6	4.3	5.5	1.1	365
Tomato	.....	90.0	1.8	1.1	5.6	1.5	185

[21] *Principles of Nutrition and Nutritive Value of Food.* U. S. Department of Agriculture. Farmer's Bulletin No. 142.

TABLE A

AVERAGE COMPOSITION OF COMMON AMERICAN FOOD PRODUCTS—*Continued*

Food materials (as purchased).	Refuse	Water	Protein	Fat	Carbohydrates	Ash	Fuel value per pound
ANIMAL FOOD—*continued.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Calories*
Poultry:							
Chicken, broilers	41.6	43.7	12.8	1.4	.....	.7	305
Fowls	25.9	47.1	13.7	12.3	.....	.7	765
Goose	17.6	38.5	13.4	29.8	.....	.7	1,475
Turkey	22.7	42.4	16.1	18.4	.....	.8	1,060
Fish:							
Cod, dressed	29.9	58.5	11.1	.2	.....	.8	220
Halibut, steaks or sections	17.7	61.9	15.3	4.4	.....	.9	475
Mackerel, whole	44.7	40.4	10.2	4.2	.....	.7	370
Perch, yellow, dressed	35.1	50.7	12.8	.7	.....	.9	275
Shad, whole	50.1	35.2	9.4	4.8	.....	.7	380
Shad, roe	.....	71.2	20.9	3.8	2.6	1.5	600
Fish, preserved:							
Cod, salt	24.9	40.2	16.0	.4	.....	18.5	325
Herring, smoked	44.4	19.2	20.5	8.8	.....	7.4	755
Fish, canned:							
Salmon	.....	63.5	21.8	12.1	.....	2.6	915
Sardines	[a]5.0	53.6	23.7	12.1	.....	5.3	950
Shellfish:							
Oysters, "solids"	.....	88.3	6.0	1.3	3.3	1.1	225
Clams	.....	80.8	10.6	1.1	5.2	2.3	340
Crabs	52.4	36.7	7.9	.9	.6	1.5	200
Lobsters	61.7	30.7	5.9	.7	.2	.8	145
Eggs: Hen's eggs	[b]11.2	65.5	13.1	9.3	.....	0.9	635
Dairy products, etc.:							
Butter	.....	11.0	1.0	85.0	.....	3.0	3,410
Whole milk	.....	87.0	3.3	4.0	5.0	.7	310
Skim milk	.....	90.5	3.4	.3	5.1	.7	165
Buttermilk	.....	91.0	3.0	.5	4.8	.7	160
Condensed milk	.....	26.9	8.8	8.3	54.1	1.9	1,430
Cream	.....	74.0	2.5	18.5	4.5	.5	865
Cheese, Cheddar	.....	27.4	27.7	36.8	4.1	4.0	2,075
Cheese, full cream	.....	34.2	25.9	33.7	2.4	3.8	1,885
VEGETABLE FOOD							
Flour, meal, etc.:							
Entire-wheat flour	.....	11.4	13.8	1.9	71.9	1.0	1,650
Graham flour	.....	11.3	13.3	2.2	71.4	1.8	1,645
Wheat flour, patent roller process							
High-grade and medium	.....	12.0	11.4	1.0	75.1	.5	1,635
Low grade	.....	12.0	14.0	1.9	71.2	.9	1,640
Macaroni, vermicelli, etc.	.....	10.3	13.4	.9	74.1	1.3	1,645
Wheat breakfast food	.....	9.6	12.1	1.8	75.2	1.3	1,680
Buckwheat flour	.....	13.6	6.4	1.2	77.9	.9	1,605
Rye flour	.....	12.9	6.8	.9	78.7	.7	1,620
Corn meal	.....	12.5	9.2	1.9	75.4	1.0	1,635
Oat breakfast food	.....	7.7	16.7	7.3	66.2	2.1	1,800
Rice	.....	12.3	8.0	.3	79.0	.4	1,620
Tapioca	.....	11.4	.4	.1	88.0	.1	1,650
Starch	.....	.....	.....	.....	90.0	.....	1,675
Bread, pastry, etc.:							
White bread	.....	35.3	9.2	1.3	53.1	1.1	1,200
Brown bread	.....	43.6	5.4	1.8	47.1	2.1	1,040
Graham bread	.....	35.7	8.9	1.8	52.1	1.5	1,195
Whole-wheat bread	.....	38.4	9.7	.9	49.7	1.3	1,130
Rye bread	.....	35.7	9.0	.6	53.2	1.5	1,170
Cake	.....	19.9	6.3	9.0	63.3	1.5	1,630
Cream crackers	.....	6.8	9.7	12.1	69.7	1.7	1,925
Oyster crackers	.....	4.8	11.3	10.5	70.5	2.9	1,910
Soda crackers	.....	5.9	9.8	9.1	73.1	2.1	1,875

[a] Refuse, oil. [b] Refuse, shell.

TABLE A

AVERAGE COMPOSITION OF COMMON AMERICAN FOOD PRODUCTS—*Continued*

Food materials (as purchased)	Refuse	Water	Protein	Fat	Carbohydrates	Ash	Fuel value per pound
VEGETABLE FOOD—*continued*							
Sugars, etc.:	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Calories.*
Molasses	.....	.....	.....	.....	70.0	.....	1,225
Candy [a]	.....	.....	.....	.....	96.0	.....	1,680
Honey	.....	.....	.....	.....	81.0	.....	1,420
Sugar, granulated	.....	.....	.....	.....	100.0	.....	1,750
Maple syrup	.....	.....	.....	.....	71.4	.....	1,250
Vegetables: [b]							
Beans, dried	.....	12.6	22.5	1.8	59.6	3.5	1,520
Beans, Lima, shelled	.....	68.5	7.1	.7	22.0	1.7	540
Beans, string	7.0	83.0	2.1	.3	6.9	.7	170
Beets	20.0	70.0	1.3	.1	7.7	.9	160
Cabbage	15.0	77.7	1.4	.2	4.8	.9	115
Celery	20.0	75.6	.9	.1	2.6	.8	65
Corn, green (sweet), edible portion	.....	75.4	3.1	1.1	19.7	.7	440
Cucumbers	15.0	81.1	.7	.2	2.6	.4	65
Lettuce	15.0	80.5	1.0	.2	2.5	.8	65
Mushrooms	.....	88.1	3.5	.4	6.8	1.2	185
Onions	10.0	78.9	1.4	.3	8.9	.5	190
Parsnips	20.0	66.4	1.3	.4	10.8	1.1	230
Peas (*Pisum sativum*), dried	.....	9.5	24.6	1.0	62.0	2.9	1,565
Peas (*Pisum sativum*), shelled	.....	74.6	7.0	.5	16.9	1.0	440
Cowpeas, dried	.....	13.0	21.4	1.4	60.8	3.4	1,505
Potatoes	20.0	62.6	1.8	.1	14.7	.8	295
Rhubarb	40.0	56.6	.4	.4	2.2	.4	60
Sweet potatoes	20.0	55.2	1.4	.6	21.9	.9	440
Spinach	.....	92.3	2.1	.3	3.2	2.1	95
Squash	50.0	44.2	.7	.2	4.5	.4	100
Tomatoes	.....	94.3	.9	.4	3.9	.5	100
Turnips	30.0	62.7	.9	.1	5.7	.6	120
Vegetables, canned:							
Baked beans	.....	68.9	6.9	2.5	19.6	2.1	555
Peas (*Pisum sativum*), green	.....	85.3	3.6	.2	9.8	1.1	235
Corn, green	.....	76.1	2.8	1.2	19.0	.9	430
Succotash	.....	75.9	3.6	1.0	18.6	.9	425
Tomatoes	.....	94.0	1.2	.2	4.0	.6	95
Fruits, berries, etc., fresh: [c]							
Apples	25.0	63.3	0.3	0.3	10.8	0.3	190
Bananas	35.0	48.9	.8	.4	14.3	.6	260
Grapes	25.0	58.0	1.0	1.2	14.4	.4	295
Lemons	30.0	62.5	.7	.5	5.9	.4	125
Muskmelons	50.0	44.8	.3	.....	4.6	.3	80
Oranges	27.0	63.4	.6	.1	8.5	.4	150
Pears	10.0	76.0	.5	.4	12.7	.4	230
Persimmons, edible portion	.....	66.1	.8	.7	31.5	.9	550
Raspberries	.....	85.8	1.0	.....	12.6	.6	220
Strawberries	5.0	85.9	.9	.6	7.0	.6	150
Watermelons	59.4	37.5	.2	.1	2.7	.1	50

[a] Plain confectionery not containing nuts, fruits, or chocolate.

[b] Such vegetables as potatoes, squash, beets, etc., have a certain amount of inedible material, skin, seeds, etc. The amount varies with the method of preparing the vegetables, and can not be accurately estimated. The figures given for refuse of vegetables, fruits, etc., are assumed to represent approximately the amount of refuse in these foods as ordinarily prepared.

[c] Fruits contain a certain proportion of inedible materials, as skins, seeds, etc., which are properly classed as refuse. In some fruits, as oranges and prunes, the amount rejected in eating is practically the same as refuse. In others, as apples and pears, more or less of the edible, material is ordinarily rejected with the skin and seeds and other inedible portions. The edible material which is thus thrown away, and should properly be classed with the waste, is here classed with the refuse. The figures for refuse here given represent, as nearly as can be ascertained, the quantities ordinarily rejected.

TABLE A

AVERAGE COMPOSITION OF COMMON AMERICAN FOOD PRODUCTS—*Continued*

Food materials (as purchased)	Refuse	Water	Protein	Fat	Carbohydrates	Ash	Fuel value per pound
VEGETABLE FOOD—*Continued.*							
Fruits, dried:	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Calories.*
Apples	.....	28.1	1.6	2.2	66.1	2.0	1,185
Apricots	.....	29.4	4.7	1.0	62.5	2.4	1,125
Dates	10.0	13.8	1.9	2.5	70.6	1.2	1,275
Figs	.....	18.8	4.3	.3	74.2	2.4	1,280
Raisins	10.0	13.1	2.3	3.0	68.5	3.1	1,265
Nuts:							
Almonds	45.0	2.7	11.5	30.2	9.5	1.1	1,515
Brazil nuts	49.6	2.6	8.6	33.7	3.5	2.0	1,485
Butternuts	86.4	.6	3.8	8.3	.5	.4	385
Chestnuts, fresh	16.0	37.8	5.2	4.5	35.4	1.1	915
Chestnuts, dried	24.0	4.5	8.1	5.3	56.4	1.7	1,385
Cocoanuts	[a]48.8	7.2	2.9	25.9	14.3	.9	1,295
Cocoanut, prepared	.....	3.5	6.3	57.4	31.5	1.3	2,865
Filberts	52.1	1.8	7.5	31.3	6.2	1.1	1,430
Hickory nuts	62.2	1.4	5.8	25.5	4.3	.8	1,145
Pecans, polished	53.2	1.4	5.2	33.3	6.2	.7	1,465
Peanuts	24.5	6.9	19.5	29.1	18.5	1.5	1,775
Piñon (*Pinus edulis*)	40.6	2.0	8.7	36.8	10.2	1.7	1,730
Walnuts, black	74.1	.6	7.2	14.6	3.0	.5	730
Walnuts, English	58.1	1.0	6.9	26.6	6.8	.6	1,250
Miscellaneous:							
Chocolate	.....	5.9	12.9	48.7	30.3	2.2	2,625
Cocoa, powdered	.....	4.6	21.6	28.9	37.7	7.2	2,160
Cereal coffee, infusion (1 part boiled in 20 parts water) [b]	.....	98.2	.2	.....	1.4	.2	30

[a] Milk and shell.

[b] The average of five analyses of cereal coffee grain is: Water 6.2, protein 13.3, fat 3.4, carbohydrates 72.6, and ash 4.5 per cent. Only a portion of the nutrients, however, enter into the infusion. The average in the table represents the available nutrients in the beverage. Infusions of genuine coffee and of tea like the above contain practically no nutrients.

TABLE B [22]

100-Calorie Portions of Common Foods

Unless otherwise specified, the figures given refer to foods as purchased, including refuse, such as bones, shells, and similar inedible materials.

The small numerals in the first column refer to the notes.

Food stuff	Quantity	Weight ounces	Protein Calories	Total Calories
Almonds	12 to 15 nuts	1.0	13	100
Apples, fresh	1 large	7.5	3	100
Apples, baked[23]	½ large and 1 tbs. sugar	2.3	1	100
Asparagus, fresh[24]	20 large stalks 8 in. long	15.9	32	100
Bacon, smoked	1 slice	.6	7	100
Bacon, fried,[23] small slices	4–5 small slices	.5	13	100
Bananas	1 large	5.5	5	100
Beans, baked, canned	½ c.	2.7	21	100
Beans, dried	2 tbs.	1.0	26	100
Beans, Lima, dried	⅛ c.	1.0	21	100
Beans, Lima, fresh, shelled	½ c.	2.9	23	100
Bean, soup, cream of[24]	½ c.	2.6	15	100
Beans, string	2¼ c. of 1 in. pieces	9.1	22	100
Beef, corned	¾ slice	1.3	21	100
Beef, dried	4 thin slices 4 in. × 5 in.	2.0	67	100
Beef juice	1⅔ c.	14.1	78	100
Beef loin	.....	1.6	29	100
Beef, sirloin steak, medium, fat, broiled[24]	slice 1¾ in. × 1½ in. × ¾ in.	1.3	31	100
Beef, roast	.....	1.0	27	100
Beef, rib, lean, roast[24]	slice 5 in. × 2½ in. × ¼ in.	1.6	46	100
Beef, round	.....	1.7	40	100
Beef, round steak, pan broiled[24]	slice 4 in. × 3 in. × 1⅛ in.	2.0	48	100
Beef, suet	2 tbs.	.5	2	100
Beets	4 beets 2 in. diam. or 1⅓ c. sliced	9.6	14	100
Bouillon	4 c.	33.6	84	100
Bread, Boston brown[23]	¾ in. slice 3 in. diam.	1.8	10	100
Bread, graham	3 slices ⅜ in. × 2 in. × 3¼ in.	1.4	14	100
Bread, white	2 slices 3 in. × 3½ in. × ½ in.	1.4	14	100

TABLE B

100-CALORIE PORTIONS OF COMMON FOODS—*Continued*

Food stuff	Quantity	Weight ounces	Protein Calories	Total Calories
Bread, whole wheat	2 slices 2½ in. × 2¾ in. × ¼ in.	1.4	16	100
Butter	1 pat or 1 tbs. scant	.5	1	100
Buttermilk	1⅛ c.	9.9	34	100
Cabbage	5c. shredded	13.3	21	100
Carrots	4–5 young carrots 3–4 in. long	10.1	10	100
Cauliflower	1 very small head	11.6	24	100
Celery	36 small stalks, or 4c. ¼ in. pieces	23.7	24	100
Cheese, American pale	1⅛ in. cube	.8	26	100
Cheese, American full cream	piece 2 in. × 1 in. × ⅜ in.	.9	25	100
Cheese, cottage	5½ tbs.	3.2	76	100
Cheese, Neuchatel	2 tbs.	1.1	23	100
Chestnuts	20	1.7	10	100
Chocolate	½ square	.6	8	100
Chocolate, milk, sweetened	piece 2¼ in. × 1 in. × ⅛ in.	.7	7	100
Cocoa	3 tbs.	.7	17	100
Cocoa, beverage	⅜ c.	5.5	14	100
Cod, salt, boneless	9 tbs.	3.1	98	100
Cookies, plain[23]	2, 2¼ in. in diam.	.9	6	100
Corn, canned	½ c.	3.6	11	100
Cornflakes	1¼ c.	1.0	6	100
Corn, green	2 ears 6 in. long	9.0	12	100
Cornmeal	3 tbs.	1.0	10	100
Corn starch	3 tbs.	1.0	0	100
Corn starch, blanc mange[23]	¼c.	2.7	9	100
Corn syrup	2 tbs. scant	1.1	0	100
Crackers, graham	2	.8	10	100
Crackers, oyster	24	.8	11	100
Crackers, saltine	6	.8	10	100
Crackers, soda	4, 3 in. sq.	.9	10	100
Cranberries	2 c.	7.6	3	100
Cranberry sauce[23]	¼ c. scant	1.5	1	100
Cream, thick (40%)	1½ tbs.	.9	2	100
Cream (18%)	¼ c.	1.8	5	100
Custard, cup[23]	½ c.	3.3	17	100
Dates, dried, unstoned	3–4	1.1	2	100
Doughnuts	½	.8	6	100
Eggs, whole, raw	1⅓	2.7	36	100
Eggs, white	7 whites	6.9	96	100
Eggs, yolk	2 yolks	1.0	17	100
Farina	3 tbs., dry	1.0	12	100
Figs, dried	1½ large	1.1	5	100
Flour, graham	3 tbs.	1.0	15	100
Flour, entire wheat	4 tbs.	1.0	15	100

TABLE B

100-CALORIE PORTIONS OF COMMON FOODS—*Continued*

Food stuff	Quantity	Weight ounces	Protein Calories	Total Calories
Flour, wheat	4 tbs.	1.0	13	100
Fowl	.....	2.1	33	100
Gelatin	3 tbs., dry	1.0	100	100
Grape fruit	½ large, 4½ diam.	12.5	0	100
Grape nuts	3 tbs.	1.0	12	100
Grapes, fresh, Concord	1 large bunch	4.9	5	100
Halibut steak	slice 3 in. × 2¼ in. × 1 in.	3.5	61	100
Ham, fresh	.....	1.2	19	100
Ham, smoked, boiled	Slice 4¾ in. × ⅛ in.	1.3	29	100
Hominy grits	3 tbs.	1.0	9	100
Honey	1 tbs.	1.1	1	100
Ice cream[23]	¼ c.	2.0	6	100
Lamb chops	½ chop	1.1	23	100
Lamb chops, broiled	1 chop 2 in. × 2 in. × ½ in.	1.6	40	100
Lard	2 ts.	.4	0	100
Lettuce	2 large heads	22.3	25	100
Macaroni	3 sticks 9 in. long	1.0	15	100
Macaroni, cooked	1 c.	5.2	15	100
Mackerel	1 c.	2.5	54	100
Mayonnaise	1 tbs.	.5	1	100
Milk, condensed, sweetened	1½ tbs.	1.1	11	100
Milk, condensed, unsweetened	3¾ tbs.	2.1	23	100
Milk, skimmed	1⅛ c.	9.6	37	100
Milk, top, 10 oz.	¼ c.	2.1	9	100
Milk, whole	⅛ c.	5.1	19	100
Molasses, cane	1½ tbs.	1.2	3	100
Mutton, leg	.....	1.8	31	100
Mutton, leg, roast[24]	piece 3 in. × 3¾ in. × ⅛ in.	1.2	33	100
Oats, rolled	5 tbs., dry	.9	17	100
Oleomargarine	1 tbs.	.5	1	100
Olive oil	1 tbs.	.4	0	100
Onions, fresh	3–4 medium	8.0	13	100
Oranges	1 large	9.5	6	100
Oysters, solids	14—⅔ c. solids	7.2	49	100
Peaches, canned	2 large halves 2½ -3 diam.	7.5	6	100
Peaches, fresh	3 medium	10.5	6	100
Peanuts	12 nuts	.9	19	100
Peanut butter	2½ ts.	.6	19	100
Pears, canned	2 halves 2 in. diam.	4.7	4	100
Peas, canned	1 c. scant	6.4	26	100
Peas, dried, split	2 tbs.	1.0	28	100
Peas, green	.....	6.4	26	100
Pineapple	½ small 4 in. diam.	15.0	4	100

TABLE B

100-CALORIE PORTIONS OF COMMON FOODS—*Continued*

Food stuff	Quantity	Weight ounces	Protein Calories	Total Calories
Pork, loin chops	1 small	1.8	32	100
Potatoes, raw	1 medium	5.3	11	100
Potatoes, sweet	½ medium	3.6	6	100
Prunes, dried	4 medium	1.4	3	100
Prunes, stewed	2 and 2 tbs. juice	2.8	2	100
Raisins	¼ c.	1.1	3	100
Raspberries, black	1⅓ c.	5.3	10	100
Rhubarb, fresh	4 c. of 1 in. pieces	25.2	11	100
Rice	2 tbs.	1.0	9	100
Rolls, Vienna or French	1, 2 in. × 3 in. × 2 in.	1.3	12	100
Salmon, canned	½ c.	2.4	54	100
Sardines, canned	3–6	1.7	47	100
Sausage, pork, cooked[24]	1¾ sausages 3 in. long, 3 in. diam. after cooking	1.1	20	100
Shredded wheat	1 biscuit	1.0	14	100
Spinach, boiled, chopped[24]	2½ c.	21.0	12	100
Squash, fresh	.....	15.6	12	100
Strawberries, fresh	1⅓ c.	9.5	10	100
Sugar, brown	3 tbs.	.9	0	100
Sugar, loaf	3½ lumps, full size	9	0	100
Sugar, white, granulated	5 ts. or 2 tbs. scant	.9	0	100
Tapioca	2 tbs.	1.0	0	100
Tapioca, apple pudding[23]	¼ c.	3.6	1	100
Tomatoes, canned	1 pint	15.6	21	100
Tomatoes, fresh	2–3 medium	15.5	16	100
Tomato soup, cream[23]	⅜ c.	3.2	11	100
Turkey	.....	1.5	28	100
Turkey, roast[24]	.....	1.3	40	100
Turnips	4 medium 2 in. diam.	12.9	13	100
Vanilla wafers	5 2-in. wafers	.8	6	100
Veal, cutlet, loin	1 cutlet	2.7	62	100
Veal, leg, roast[24]	Slice 2 in. × 2¾ in. × ⅛ in.	2.3	71	100
Veal liver	.....	2.9	61	100
Walnuts, Cal	4–8	1.9	10	100
Walnuts, Cal., meats	8–16	.5	10	100
Zwieback	3 pieces 3¼ in. × ½ in. × 1¼ in.	.8	9	100

[23] Adapted from *The Laboratory Manual for Dietetics*, by Mary Swartz Rose, and *Feeding the Family*, by Mary Swartz Rose. Used by permission of and special arrangement with the Macmillan Company, Publishers.

[23] The recipe upon which this estimate is based is given on page 183.

[24] This estimate is based upon the weight of the food after it has been cooked, and it does not include the food value of the fat left in the pan, nor in the case of vegetables, of fats and other ingredients used in preparing food for the table.

Recipes used in estimating the fuel values of the foods in Table B: [25]

Apples, baked
- 1 large apple
- 2 tbs. sugar
- 1 tbs. water

Bean soup, cream of
- 2 tbs. butter
- 4 tbs. flour
- 1⅓ c. water
- 1⅓ c. milk
- 1 c. bean pulp
- seasonings

Bread, Boston brown
- 1 c. rye meal
- 1 c. cornmeal
- 1 c. graham flour
- ¾ ts. soda
- 1 ts. salt
- ¾ c. molasses
- 2 c. sour milk

Cornstarch, blanc mange
- 4 tbs. cornstarch
- ⅓ c. sugar
- 2 c. milk
- ½ ts. vanilla

Cocoa, beverage
- ½ c. milk
- ½ c. water
- 2 ts. cocoa
- 2 ts. sugar

Cookies, plain
- ½ c. butter
- 1 c. sugar
- 1 egg
- ¼ c. milk
- 2 ts. baking powder
- 2½ c. flour

Cranberry sauce
- 1 c. cranberries
- ½ c. sugar
- ½ c. water

Custard, cup
- 3 c. milk
- 3 eggs
- 6 tbs. sugar

Ice cream
- 2 c. skim-milk
- 1 tbs. flour
- 1 c. sugar
- 1 egg
- 1 qt. thin cream
- 2 ts. vanilla

Prunes, stewed
- 1 lb. prunes (48 prunes)
- 1 c. sugar
- water

Tapioca, apple pudding
- ½ c. tapioca
- 4 apples
- ½ c. sugar
- 3 c. water
- Few grains salt

Tomato, cream of, soup
- 2 c. canned tomatoes
- 2 ts. sugar
- 1 qt. milk
- 4 tbs. flour
- ⅓ c. butter
- ⅛ medium onion
- Soda and seasonings

[25] These recipes are taken from *Feeding the Family*, by Mary Swartz Rose. Used by permission of and special arrangement with the Macmillan Company, Publishers.

TABLE C.

PRICE LIST[26]

Food	Price	Equivalent Measures and Weights	Current Local Prices
Apples	$.12 per qt.	1 qt. = 25 oz.[27]	
Apple pie	.25 per pie (4 servings)	1 pie = 18 oz.	
Asparagus	.15 per bunch	1 bunch = 35 oz.	
Bacon	.45 per lb.	2 thin slices = 1 oz.	
Baking powder	.30 per can	1 can = 1 lb. 1 cup = 6 oz.	
Bananas	.35 per dozen	1 doz. = 3 lbs.	
Beans, canned, baked	.15 per can	1 can = 20 oz.	
Beans, dried	.14 per lb.	1 cup = 7 oz.	
Beans, Lima, fresh, shelled	.27 per qt.	1 qt. = 20 oz.	
Beans, string	.08 per qt.	1 qt. = 12 oz.[27]	
Beef, corned	.22 per lb.		
Beef, porterhouse	.50 per lb.		
Beef, rib roast	.35 per lb.		
Beef, round	.35 per lb.		
Beef, shoulder	.30 per lb.		
Beef, sirloin	.50 per lb.		
Beets, fresh	.05 per bunch	1 bunch = 24 oz.	
Blue fish	.20 per lb.		
Bouillon[28]	.20 per can	1 can = 16 oz.	
Bread, graham	.10 per loaf	1 loaf = 16 oz.	
Bread, rye	.10 per loaf	1 loaf = 16 oz.	
Bread, white	.10 per loaf	1 loaf = 16 oz.	
Bread, white, home-made	.14 per loaf	1 loaf = 16 oz.	
Butter	.48 per lb.	1 cup = 8 oz.	
Butter milk	.10 per qt.	1 qt. = 34 oz.	
Cabbage	.05 per lb.	1 head = 4 lbs.	
Carrots	.05 per bunch	1 bunch = 10 oz.	
Cauliflower	.25 per head	1 head = 2 lbs.	
Celery	.10 per bunch	1 bunch = 3 stalks 1 bunch = 10 oz.	
Cheese, American	.30 per lb.	1 cup, packed solid = 8 oz. 1 cup, grated = 4 oz.	
Cheese, cream	.12 per cheese	1 cheese = 3 oz.	
Cheese, full cream	.35 per lb.	1 cup, packed solid = 8 oz. 1 cup, grated = 4 oz.	
Cheese, Swiss	.55 per lb.		
Chicken	.45 per lb.		
Chicken soup[28]	.20 per can	1 can = 16 oz.	
Chocolate, bitter	.40 per lb.	1 sq. = 1 oz.	
Chocolate, German's sweet	.10 per cake	1 cake = 4 oz.	

TABLE C

PRICE LIST—*Continued.*

Food	Price	Equivalent Measures and Weights	Current Local Prices
Cocoa	$.25 per can	1 can = 8 oz. 1 cup = 4½ oz.	
Cod, salt	.25 per lb.		
Coffee	.30 per lb.	4 tbs. = 1 oz. 1 cup = 4 oz.	
Cookies, sugar, 3 in. diam. thick	.18 per doz.	1 doz. = 10 oz.	
Corn, canned	.17 per can	1 can = 20 oz.	
Cornflakes	.15 per box	1 box = 10 oz.	
Cornmeal	.06½ per lb.	1 cup = 5 oz.	
Cornstarch	.10 per pkg.	1 pkg. = 16 oz. 1 cup = 4½ oz.	
Corn syrup	.15 per can	1 can = 20 oz.	
Crackers, graham	.18 per pkg.	1 pkg. = 8½ oz.	
Crackers, oyster	.18 per lb.		
Crackers, saltines	.25 per pkg.	1 pkg. = 9½ oz. 1 pkg. = 80 crackers	
Crackers, soda	.10 per pkg.	1 pkg. = 4⅝ oz. 1 pkg. = 22 crackers	
Cranberries	.15 per qt.	1 qt. = 16 oz.[27]	
Cream of wheat	.25 per box	1 box = 28 oz. 1 cup = 6 oz.	
Cream, 40%	.20 per ½ pt.	½ pt. = 7¾ oz.	
Crisco	.35 per can	1 can = 24 oz.	
Dates	.25 per box	1 box = 12 oz.	
Doughnuts, homemade	.25 per doz.	1 doz. = 19 oz.	
Eggs	.55 per doz.	1 doz. = 27 oz. 7 eggs = 16 oz.	
Figs	.20 per lb.	24 figs = 16 oz.	
Flour, barley	.38 per sack	1 sack = 5 lbs. 1 cup = 3⅓ oz.	
Flour, corn	.07 per lb.	1 cup = 4½ oz.	
Flour, graham	.35 per sack	1 sack = 5 lb. 1 cup = 5 oz.	
Flour, potato	.18 per lb.	1 cup = 6 oz.	
Flour, rice	.14 per lb.	1 cup = 5 oz.	
Flour, rye	.38 per sack	1 sack = 5 lb. 1 cup = 5 oz.	
Flour, wheat	1.48 per bag	1 bag = 24½ lbs. 1 cup, sifted = 4 oz.	
Flour, whole wheat	.35 per sack	1 sack = 5 lb. 1 cup = 5 oz.	
Gelatin, granulated	.10 per pkg.	1 pkg. = 1 oz. 3 tbs. = 1 oz.	
Grape fruit	.10 a piece		

TABLE C

PRICE LIST—*Continued*

Food	Price	Equivalent Measures and Weights	Current Local Prices
Grape nuts	$.14 per pkg.	1 pkg. = 14 oz.	
Haddock	.15 per lb.		
Halibut	.35 per lb.		
Ham, fresh	.38 per lb.		
Ham, smoked	.35 per lb.		
Hominy grits	.15 per box	1 box = 28 oz. 1 cup = 5½ oz.	
Hominy, pearl	.15 per box	1 box = 28 oz.	
Honey	.30 per lb.		
Ice cream	.60 per qt.	1 qt. = 32 oz.	
Lamb chops	.55 per lb.		
Lard	.33 per lb.	1 cup = 8 oz.	
Lemons	.45 per doz.	1 doz. = 3 lbs.	
Lettuce	.10 per head	1 head = 9 oz.	
Liver, veal	.38 per lb.		
Macaroni	.12 per pkg.	1 pkg. = 12 oz.	
Mackerel	.25 per lb.		
Maple syrup	2.50 per gal.	1 gal. = 8 lb.	
Milk, condensed, sweetened	.17 per can	1 can = 16 oz.	
Milk, skimmed	.05 per qt.	1 qt. = 34 oz.	
Milk, whole	.14 per qt.	1 qt. = 34 oz.	
Molasses, cane	.15 per can	1 can = 26 oz. 1 cup = 12 oz.	
Mutton, leg	.35 per lb.		
Mutton, loin chops	.50 per lb.		
Oats, rolled	.13 per box	1 box = 20 oz. 6 cups = 16 oz.	
Oil, cottonseed table	1.80 per can	1 can = 80 oz.	
Oil, olive	7.50 per gal	1 gal. = 7½ lb.	
	3.00 per qt.	1 cup = 7½ oz.	
Oleomargarine	.33 per lb.	1 cup = 8 oz.	
Onions	.10 per qt.	1 qt. = 28 ½ oz.[27]	
Oranges	.70 per doz.	1 doz. = 5¼ lb.	
Oysters	.50 per qt.	1 qt. = 32 oz. 1 qt. = 28 oysters	
Peaches, canned	.24 per can	1 can = 30 oz.	
Peaches, fresh	1.75 per ½ bu.	½ bu. = 25 lb.[27]	
Peanuts	.25 per lb.	1 cup = 2½ oz. 12 peanuts = 1 oz.	
Peas, canned	.12½ per can	1 can = 20 oz.	
Peas, dried, split	.16 per lb.	1 cup = 7½ oz.	
Peas, green	.07½ per qt.	1 qt. = 30 oz.[27]	
Pepper	.10 per box	1 box = 4 oz.	
Pickles, Dill	.15 per doz.		

TABLE C

PRICE LIST—*Continued*

Food	Price	Equivalent Measures and Weights	Current Local Prices
Pork, loin chops	.40 per lb.		
Pork, salt	.42 per lb.		
Potatoes, sweet	.08 per qt.	1 qt. = 27 oz.[27]	
Potatoes, white	1.30 per ½ bu.	½ bu. = 30 lb.[27]	
Prunes, dried	.15 per lb.	48 prunes = 16 oz.	
Raisins, seeded	.14 per pkg.	1 pkg. = 15 oz.	
Rice	.14 per lb.	1 cup = 8 oz.	
Rolls	.20 per doz.	1 doz. = 16 oz.	
Salmon	.25 per can	1 can = 16 oz.	
Salt	.05 per bag	1 bag = 40 oz.	
Sausage meat	.22 per lb.	1 cup = 8 oz.	
Shredded wheat	.14 per box	1 box = 12 oz. 1 box = 12 biscuits	
Soda	.08 per box	1 box = 16 oz. 1 cup = 8 oz.	
Spinach	.15 per peck	1 peck = 3 lb.[27]	
Sugar, brown	.09½ per lb.	1 cup = 5 ⅞ oz.	
Sugar, domino	.14 per lb.	4 full size lumps = 1 oz.	
Sugar, granulated	.09½ per lb.	1 cup equals 7 ¾ oz.	
Sugar, powdered	.11 per lb.	1 cup = 6 oz.	
Tapioca	.10 per pkg.	1 pkg. = 16 oz. 1 cup = 6½ oz.	
Tea	.50 per lb.	6 tbs. = 1 oz.	
Tomato soup[28]	.20 per can	1 can = 16 oz.	
Tomatoes, canned	.20 per can	1 can = 32 oz.	
Tomatoes, fresh	.25 per 4 qt.	1 qt. = 28 oz.[27] 3 tomatoes = 16 oz.	
Turkey	.60 per lb.		
Vanilla	.25 per bottle	1 bottle = 2 oz.	
Veal cutlet	.45 per lb.		
Vinegar	.15 per bottle	1 bottle = 26 oz.	
Walnut meats	1.00 per lb.	16 meats = 1 oz.	
Walnuts, unshelled	.30 per lb.	35 nuts = 16 oz.	
Wheatena	.25 per box	1 box = 23 oz. 1 cup = 6 oz.	

[26] The prices are local prices for Detroit, Michigan (1918). The data in column 3, Equivalent Measures and Weights, have been obtained, as far as possible, by actually weighing the foods. When this has not been possible, the weights have been obtained by consultation with merchants and from the following sources:

Get Your Money's Worth, Key to Economy, issued by Department of Weights and Measures, Newark, N. J., and *Feeding the Family*, by Mary Swartz Rose. Used by permission of and special arrangement with the Macmillan Company, Publishers.

[27] *Get Your Money's Worth, Key to Economy.* Issued by Department of Weights and Measures, Newark, N. J.

[28] These prices and weights are for soups, not concentrated but ready to serve.

TABLE D

Weight of Common Measures of Food Materials

Material	Weight in ounces	
	1 cup	1 tbs.
Baking powder	—	⅜
Beans, navy, dried	7	—
Beans, Lima, dried	5½	—
Bread crumbs, stale	3	—
Butter	8	½
Cheese, grated	4	¼
Cheese, packed solid	8	—
Cocoa	4½	¼
Cod, shredded	6	—
Coffee	4	¼
Cornmeal	5	½
Cornstarch	4½	¼
Cream, thick	7¾	⅜
Cream, thin	8	½
Crisco	6⅓	⅜
Farina	6	⅜
Flour, graham	5	½
Flour, wheat, sifted	4	¼
Gelatin, granulated	—	½
Lard	8	½
Meat, chopped	8	½
Milk	8½	9/10
Milk, condensed, unsweetened	11	9/10
Milk, condensed, sweetened	8	⅔
Nuts, chopped	3	—
Oats, rolled	2½	—
Olive oil	7½	⅔
Peas, dried	7½	½
Rice, uncooked	7	½
Salt	—	½
Soda	—	½
Suet	3½	—
Sugar, brown	5⅓	⅓
Sugar, granulated	7⅞	½
Sugar, powdered	6	⅜
Tapioca	6½	⅜
Tea	2½	⅛

TABLE E

Tables of Weights and Measures

ENGLISH SYSTEM

Linear Measure

12 inches (in.) = 1 foot (ft.)[29]
3 feet = 1 yard (yd.)
5½ yards, or 16½ feet = 1 rd. (rd.)
320 rods, or 5280 feet = 1 mile (mi.)

Square Measure

144 square inches (sq. in.) = 1 sq. foot (sq. ft.)
9 square feet = 1 square yard (sq. yd.)
30¼ square yards = 1 square rod (sq. rd.)
160 square rods = 1 acre (A.)
640 acres = 1 square mile (sq. mi.)

Cubic Measure

1728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.)
27 cubic feet = 1 cubic yard (cu. yd.)
128 cubic feet = 1 cord (cd.)

Weight (Avoirdupois)

16 ounces (oz.) = 1 pound (lb.)
2000 pounds = 1 ton (T.)

Liquid Measure

4 gills (gi.) = 1 pint (pt.)
2 pints = 1 quart (qt.)
4 quarts = 1 gallon (gal.)

METRIC SYSTEM

Measures of Length

10 millimeters (mm.) = 1 centimeter (cm.)
10 centimeters = 1 decimeter (dm.)
10 decimeters = 1 meter (m.)
10 meters = 1 dekameter (Dm.)
10 dekameters = 1 hektometer (Hm.)
10 hektometers = 1 kilometer (Km.)

Measures of Capacity

10 milliliters (ml.) = 1 centiliter (cl.)
10 centiliters = 1 deciliter (dl.)
10 deciliters = 1 liter (l.)
10 liters = 1 dekaliter (Dl.)
10 dekaliters = 1 hektoliter (Hl.)
10 hektoliters = 1 kiloliter (Kl.)

[29] The signs ′ and ″ are used to represent feet and inches respectively; thus, 3 ft. 2 in. may be written 3′ 2″.

TABLE E

TABLES OF WEIGHTS AND MEASURES—*Continued*

Measures of Weight

10 milligrams (mg.) = 1 **centigram** (cg.)
10 centigrams = 1 **decigram** (dg.)
10 decigrams = 1 **gram** (g.)
10 grams = 1 **dekagram** (Dg.)
10 dekagrams = 1 **hektogram** (Hg.)
10 hektograms = 1 **kilogram** (Kg.)
1000 kilograms = 1 **ton** (T.)

Metric Equivalent Measures

1 meter = 39.37 in. = 3.28083 **ft.** = 1.0936 yd.
1 centimeter = .3937 inch
1 kilometer = .62137 mile
1 inch = 2.54 centimeters = 25.4 millimeters
1 liter = 1.0567 quarts
1 liter = 2.202 lb. of water **at 62° F.**
1 quart = .946 liter
1 gram = .0353 oz.
1 kilogram = 2.2045 pounds
1 ounce, avoirdupois = 28.35 grams
1 pound = .4536 kilogram = **453.6 grams**

HIGHER LIFE

HIGHER LIFE

Budgets of Expenditures for Higher Life

It is in the expenditures for higher life that the individuality of the family is most apparent. If the income is large enough to permit of a moderate allowance for this budget division then there is opportunity for some choice in the matter of expenditures, but this is more or less impossible if the family income falls below $1000. Many subdivisions of the expenditures for higher life may be made to suit the needs or desires of different families, but these may be classified under five main divisions: health, beneficence, recreation, education, and incidentals. The principal objects for which money is expended in each of these divisions are as follows:

Health.—Doctor, dentist, nurse, medicine.

Beneficence.—Church, contributions to charity, relief work.

Recreation.—Athletics, theater, moving pictures, travel, vacation.

Education.—Schooling, books, periodicals, newspapers, music, lectures, societies.

Incidentals.—Gifts to friends, unclassified expenditures.

It is also customary to include savings and investments under higher life.

For the purpose of comparing the expenditures of different families for higher life, an arbitrary standard may be set up and used as the basis of comparison. Expenditures for the various objects exclusive of incidentals will then be rated according as they conform to this standard. A score-card for this purpose may be devised in which records conforming to the standard would be rated 100 points.

Score-card for Grading Expenditures for Higher Life[1]

Standard	Possible Score	Actual Score
A. Minimum amount to be devoted to higher life: 25 per cent. of the total family income	50	
B. Minimum amounts to be expended on subdivisions of higher life	50	
Savings .....20 per cent. of the total devoted to higher life		

[1] From MSS. of B. R. Andrews, Teachers College, Columbia University.

Standard		Possible Score	Actual Score
Education	10 per cent. of the total devoted to higher life		
Beneficence	10 per cent. of the total devoted to higher life		
Recreation	5 per cent. of the total devoted to higher life		
Health	5 per cent. of the total devoted to higher life		
		50	
		100	

Directions.—Under A, deduct 1 point for each per cent. of the amount expended for higher life less than 25 per cent.

Under B, deduct 2 points for each per cent. of deficiency below the minimum per cent. given for any division; but not a total of over 50 points.

EXERCISE I

Problem.—A teacher with a salary of $1200 made the following expenditures for higher life: Church, $100; beneficence, $150; health, $30; insurance, $27.50; incidentals, $6.50; books and magazines, $15; recreation, $7.50. Find the per cent. of the total for higher life that was expended on each division of the budget. Grade the expenditures according to the method suggested above.

$100 + $150 + $30 + $27.50 + $15 + $7.50 + $6.50
= $336.50, the total amount spent for higher life, or 28 per cent. of the total income.

$100 + $150 = $250, the total for beneficence.

$27.50 ÷ $336.50 = .08, or 8%, the per cent. of the total expended for savings.

$15 ÷ $336.50 = .04, or 4%, the per cent. of the total expended for education.

$250 ÷ $336.50 = .74, or 74%, the per cent. of the total expended for beneficence.

$7.50 ÷ $336.50 = .02, or 2%, the per cent. of the total expended for recreation.

$30 ÷ $336.50 = .09, or 9%, the per cent. of the total expended for health.

$336.50 ÷ $1200 = .28, or 28%, the per cent. of the income for higher life.

The score for *A* is 50, since more than 25 per cent. of the income is expended for higher life.

In *B* 24 pts. are deducted for a 12 per cent. deficiency in savings.
12 pts., for a 6 per cent. deficiency in education.
6 pts., for a 3 per cent. deficiency in recreation.

42 pts., the total number of points deducted.

50 − 42 = 8, the score for *B*.

50 + 8 = 58, the total score.

The scores should be entered in the proper places on the score-card.

In the following budgets, find the per cent. of the total amount for higher life expended on each division of the budget. Grade the expenditures, using the score-card:

1. Clergyman. Salary, $1000.

Expenditures:

Poor fund	$14.00	Newspapers	$3.25
Doctor's bills	18.90	Concerts	1.50
Missions	5.00	Party for children	3.85
Medicine	10.50	Pleasure	9.50
Red Cross	6.00	Insurance	80.00
Books	18.00	Trip to conference	55.00
Magazines	3.00		

2. Clerk. Salary, $1200.

Expenditures:

Church subscriptions	$24.00	Athletics	$14.50
Patriotic fund	12.00	Y. M. C. A.	5.00
Dentist	6.50	Pleasures	5.00
Doctor	4.00	Magazines	6.00
Insurance	28.40	Newspapers	8.50
Theater	10.50	Music lessons	24.00
Dances	6.80	Medicine	3.25

3. Accountant. Income, $1550.

Expenditures:

Red Cross	$5.00	Church	$12.00
Charity Organization	5.00	Doctor	18.00
Hospital	3.00	Dentist	12.00
Armenian and Syrian Relief	20.00	Medicine	6.62
Y. M. C. A. and Y. W. C. A.	10.00	Insurance	218.59
War Camp Community Service	10.00	Newspapers and magazines	10.40
		Theaters and movies	4.00
		Entertaining	11.60

4. Farmer. Income, $1800

Expenditures:

Medical aid	$26.70	Vacation trip	$113.25
Church	15.79	Club dues	20.00
Refurnishing	80.00	Charity	25.00
Amusement	20.00	Christmas gifts	45.00
Life insurance	95.00	Improvements to property	16.80
Magazines and papers	24.00	Savings	400.00
Books	22.00		

5. Mechanic. Income, $1000.

Expenditures:

Church	$12.00	Insurance	$36.75
Subscription for new church	80.00	Savings bank	60.00
War fund	12.00	Papers	3.25
Doctor	4.00	Books	1.75
Medicine	8.25	Amusements	15.00

Saving and Investment

Not all of the family income should be expended for food, clothing, shelter, and the other items of the household budget, but a definite part should be set aside each year as savings. There may come a time when the earning power of the bread-winner of the family is lessened because of old age, sickness, or loss of position; bills may arise from unforeseen emergencies, such as sickness or accident; money may be required for the education of the children or for travel. To meet the needs of these situations the savings of previous years should be available.

Amount of $1 at Compound Interest from 1 to 25 Years

Years	3½%	4%	4½%	5%	5½%	6%
1	1.035000	1.040000	1.045000	1.050000	1.055000	1.060000
2	1.071225	1.081600	1.092025	1.102500	1.113025	1.123600
3	1.108718	1.124864	1.141166	1.157625	1.174241	1.191016
4	1.147523	1.169859	1.192519	1.215506	1.238825	1.262477
5	1.187686	1.216653	1.246182	1.276282	1.306960	1.338226
6	1.229255	1.265319	1.302260	1.340096	1.378843	1.418519
7	1.272279	1.315932	1.360862	1.407100	1.454679	1.503630
8	1.316809	1.368569	1.422101	1.477455	1.534687	1.593848
9	1.362897	1.423312	1.486095	1.551328	1.619094	1.689479
10	1.410599	1.480244	1.552969	1.628895	1.708144	1.790848
11	1.459970	1.539454	1.622853	1.710339	1.802092	1.898299
12	1.511069	1.601032	1.695881	1.795856	1.901207	2.012196
13	1.563956	1.665074	1.772196	1.885649	2.005774	2.132928
14	1.618695	1.731676	1.851945	1.979932	2.116091	2.260904
15	1.675349	1.800944	1.935282	2.078928	2.232476	2.396558
16	1.733986	1.872981	2.022370	2.182875	2.355263	2.540352
17	1.794676	1.947901	2.113377	2.292018	2.484802	2.692773
18	1.857489	2.025817	2.208479	2.406619	2.621466	2.854339
19	1.922501	2.106849	2.307860	2.526950	2.765647	3.025600
20	1.989789	2.191123	2.411714	2.653298	2.917757	3.207135
21	2.059431	2.278768	2.520241	2.785963	3.078234	3.399564
22	2.131512	2.369919	2.633652	2.925261	3.247537	3.603537
23	2.206114	2.464716	2.752166	3.071524	3.426152	3.819750
24	2.283328	2.563304	2.876014	2.225100	3.614590	4.048935
25	2.363245	2.665836	3.005434	3.386355	3.813392	4.291871

There are many ways of investing these savings, among the most important of which are the savings bank account, the postal savings deposit, shares in a building and loan association, life insurance, investments in stocks, bonds, mortgages, government securities, and real estate.

Investments that pay more than 5 per cent. or 6 per cent. interest usually involve an element of risk and are not recommended for the small investor.

AMOUNT OF $1 PER ANNUM AT COMPOUND INTEREST FROM 1 TO 20 YEARS

Years	3½%	4%	4½%	5%	5½%	6%
1	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
2	2.035000	2.040000	2.045000	2.050000	2.055000	2.060000
3	3.106225	3.121600	3.137025	3.152500	3.168025	3.183600
4	4.214943	4.246464	4.278191	4.310125	4.342266	4.374616
5	5.362466	5.416323	5.470710	5.525631	5.581091	5.637093
6	6.550152	6.632975	6.716892	6.801913	6.888051	6.975319
7	7.779408	7.898294	8.019152	8.142008	8.266894	8.393838
8	9.051687	9.214226	9.380014	9.549109	9.721573	9.897468
9	10.368496	10.582795	10.802114	11.026564	11.256260	11.491316
10	11.731393	12.006107	12.288209	12.577893	12.875354	13.180795
11	13.141992	13.486351	13.841179	14.206787	14.583498	14.971643
12	14.601962	15.025805	15.464032	15.917127	16.385590	16.869941
13	16.113030	16.626838	17.159913	17.712983	18.286797	18.882138
14	17.676986	18.291911	18.932109	19.598632	20.292571	21.015066
15	19.295681	20.023588	20.784054	21.578564	22.408662	23.275970
16	20.971030	21.824531	22.719337	23.657492	24.641138	25.672528
17	22.705016	23.697512	24.741707	25.840366	26.996401	28.212880
18	24.499691	25.645413	26.855084	28.132385	29.481203	30.905653
19	26.357181	27.671229	29.063562	30.539004	32.102669	33.759992
20	28.279682	29.778079	31.371423	33.065954	34.868316	36.785591

EXERCISE II

Problem.—A girl received a legacy of $500 when she was 3 years old. It was invested for her at 4 per cent. compound interest. What did it amount to when she was 21 years old?

From the compound interest table on page 196 it will be seen that $1 amounts to $2.025817 in 18 years.

Hence $500 will amount to 500 × $2.025817 or $1012.91.

Problem.—A young man deposited $150 annually in a savings bank that pays 3½ per cent. compound interest. What did his savings amount to at the end of 10 years?

From the above table it will be seen that $1 deposited annually at 3½ per cent. interest for 10 years amounts to $11.731393.

Hence $150 deposited annually for 10 years will amount to 150 × $11.731393 or $1759.71.

1. In order to buy a wrist watch, Helen decided not to spend all of her allowance on ice cream and the movies, but to put 15 cents into the savings bank each week. At 4½ per cent. interest, compounded annually, how much money would she have at the end of 5 years?

2. Helen's chum wants to buy a $50 bond. If she can put 25 cents a week into a savings bank that pays 4½ per cent. interest, compounded annually, how long will it take her to save enough money to buy the bond?

3. A War Savings Stamp cost $4.18 in July, 1919. On January 1, 1924, the government will pay $5 to the owner of the stamp. Show that the interest on the stamp is figured at the rate of 4 per cent. compounded quarterly.

4. Mary Jones has a War Savings Certificate which is a folder containing $5 War Savings Stamps. She bought one stamp each month for 5 months, beginning April, 1918, when a stamp cost $4.15. The stamps increased in cost 1 cent each month. In 1923 when the certificate can be redeemed for its face value, how much interest will she receive?

5. Mr. Johnson began when his son was 4 years old investing $75 for him on each birthday. If the money is invested at 4 per cent. compound interest, how much will it amount to on the boy's 21st birthday?

6. Harvey Jones saves 5 cents a week for 10 years and deposits his savings annually in a savings bank that pays 4 per cent. interest. How much will he have at the end of this time?

7. Margaret Stevens, a seamstress, finds that she can save on an average of $10 a month. If she deposits her savings annually in a savings bank paying 3½ per cent. compound interest, what will they amount to at the end of 12 years?

8. Hilda Jackson received a legacy of $1500 when she was 40 years old. She invested it in such a way as to bring 5 per cent. compound interest. What did it amount to when she was 60 years old and obliged to retire from business? If she reinvested it at this time at 6 per cent. simple interest, what annual income did she receive from her investment?

9. What would a woman 35 years old have to save annually, if she invested it at 4 per cent. compound interest, in order to have her savings amount to $10,000 by the time she is 60 years old?

10. A man has partially provided for his family in case of his death by taking out a life insurance policy for $5000 on which he pays an annual premium of $125.20. If he can invest his additional savings so as to bring 4½ per cent. compound interest, how much more will he have to save annually to provide another $5000 by the end of 20 years?

Postal Savings Deposits

The postal savings system of the United States is in operation in a large number of post offices throughout the country. In these post offices any person may make a deposit of a dollar or more. Receipts for deposits are issued in the form of postal savings certificates. Since these certificates are made out in denominations of $1, $2, $5, $10, $20, $50, it is evident that no fraction of a dollar will be received for deposit. One may, however, deposit less than a dollar in the form of postal savings stamps, but without interest.

Each certificate bears interest at the rate of 2 per cent. from the first of the month following that in which it was purchased. This interest is payable annually, but no interest is paid on money which remains on deposit for less than a year. Compound interest is not allowed, but a depositor may use the interest to purchase a new certificate which will bear interest.

Although the rate of interest is low, many people prefer this method of investing savings because the government guarantees the payment of the money.

EXERCISE III

Problem.—Find the interest on $45 on deposit in a postal savings bank for three years, if the interest, when it amounted to $1 or more, was invested in a new certificate.

3 × 2 per cent. of $45 = $2.70, the interest for three years.
At the end of the second year the interest was $1.80, one dollar of which was invested in a new certificate. The interest on this certificate at the end of the third year was 2 cents, making the total interest $2.72.

Find the amount of the principal and interest on the following sums deposited in a postal savings bank, if the interest is invested when it amounts to $1 or more.

1. $15 for 2 years.
2. $55 for 3 years.
3. $35 for 6 years.
4. $10 for 5 years.
5. $73 for 8 years.
6. $120 for 6 years.

7. Mary Jones made the following deposits in a postal savings bank: \$3, March 12, 1913; \$4, May 5, 1913; \$1, June 4, 1913; \$2, Sept. 20, 1913; \$5, Oct. 5, 1913; \$10, Dec. 27, 1913; \$3, Feb. 7, 1914; \$1, March 4, 1914; \$2, April 6, 1914. What was the amount of the principal and interest on April 1, 1915?

8. If \$1 is deposited each month for three years, what will be the amount of principal and interest at the end of that time?

9. \$45 is deposited quarterly for five years. At the end of the time what will be the amount of the principal and interest, if the interest is used for new certificates whenever it amounts to \$1 or more?

Savings Bank Accounts

A savings bank is a bank with the purpose of receiving small deposits of money and paying interest thereon. It is under the control of state laws. Hence it furnishes a safe as well as convenient method of investing small amounts. When the savings have accumulated to a sufficient amount, they may often wisely be withdrawn and used for investments drawing a higher rate of interest, such as bonds, mortgages, etc., although the individual investment in the latter form is not usually as secure as the savings bank deposit.

Interest is paid on the money deposited at the rate of 3 per cent. or 4 per cent., but no interest is paid on fractions of a dollar. The interest is payable semiannually or quarterly. Some banks allow interest from the first of each month, others from the first of each quarter, and still others from the first of each half-year. The interest is usually computed on the smallest balance on hand between this day and the next interest day. A withdrawal may cancel the interest on the sum withdrawn for the entire interest period or for the quarter. Banks have different rules in regard to the payments of interest. These are printed in the pass-books and should be carefully studied by the depositor.

The interest dates are most frequently January 1 and July 1. When interest becomes due, it may be withdrawn or it may be left to the credit of the depositor. If it is left on deposit, it will draw interest. Savings banks, therefore, pay compound interest.

EXERCISE IV

Problem.—Find the balance due Jan. 1, 1913, on the following savings bank account: Mrs. Jones opened the account on Sept. 30, 1911, by depositing \$45. She deposited Jan. 9, 1912, \$75; deposited April 1, 1912,

$73; withdrew May 6, 1912, $50; deposited June 1, 1912, $45; deposited Sept. 20, 1912, $70; withdrew Oct. 10, 1912, $35; deposited Nov. 1, 1912, $20. Interest is computed at the rate of 4 per cent. per annum on all amounts that have been on deposit for 6 months or 3 months prior to the interest dates of Jan. 1 and July 1.

Dates	Deposits	Withdrawals	Interest	Balance
Sept. 30, 1911	$45	...	...	$45.00
Jan. 1, 1912	...	...	$.45	45.45
Jan. 9, 1912	75	...	...	120.45
April 1, 1912	73	...	...	193.45
May 6, 1912	...	$50	...	143.45
June 1, 1912	45	...	...	188.45
July 1, 1912	...	...	1.88	190.33
Sept. 20, 1912	70	...	...	260.33
Oct. 10, 1912	...	35	...	225.33
Nov. 1, 1912	20	...	...	245.33
Jan. 1, 1913	...	...	4.15	249.48

$45 × .01 = $.45, the interest on $45 for 3 months, due Jan. 1, 1912.
$45.45 is the smallest amount on deposit from Jan. 1, 1912, to April 1, 1912, and $143.45 is the smallest amount on deposit from April 1, 1912, to July 1, 1912.
Hence, $45 × .01 + $143 × .01, or $1.88, is the amount of interest due July 1.
$190 × .01 + $225 × .01, or $4.15, is the amount of interest due Jan. 1, 1913. ($190 and $225, the smallest amounts on deposit in third and fourth quarters.)

In the examples 1–5 compute the interest semiannually, on July 1 and January 1, allowing interest on all sums that have been on deposit 6 months or 3 months prior to the interest dates.

1. Find the balance in the bank July 1, 1918, if $250 was deposited in the bank July 1, 1917, bearing interest at the rate of 4 per cent. per annum.

2. $470 was deposited in a savings bank on June 20, 1914. Find the balance in the bank on July 1, 1917, if the rate is 3½ per cent. per annum.

3. $525 was deposited on May 5, 1915. If the rate of interest was 3 per cent., what was the balance in the bank on January 1, 1916?

4. If $120 was deposited in a savings bank on May 17, 1916, bearing interest at the rate of 3 per cent. per annum, what would be the amount of the principal and interest on January 1, 1918?

5. Find the balance in the bank July 1, 1918, if $48 is deposited on August 3, 1914, bearing interest at the rate of 4 per cent. per annum.

6. Find the amount of the principal and interest in the examples 1–5 if the interest is compounded quarterly on January,1, April 1, July 1, and October 1.

7. If interest at the rate of 4 per cent. per annum is allowed from the beginning of each half year and is credited to the account on January 1 and July 1, prepare a statement of the following account to July 1, 1918, similar to that on page 201. Deposited January 25, 1913, $45; deposited March 25, 1913, $50; deposited April 6, 1913, $20; deposited May 7, 1913, $60; deposited July 3, 1913, $40; withdrew August 4, 1913, $50; deposited September 30, 1913, $75; deposited November 1, 1913, $30; withdrew January 3, 1914, $20; deposited March 3, 1914, $45; deposited June 4, 1914, $50.

8. Make a statement of the following savings bank account, finding the balance due on July 1, 1918: Mrs. Brown had a balance of $125 in the bank on July 1, 1916. She deposited September 26, 1916, $60; deposited November 2, 1916, $20; deposited January 7, 1917, $65; withdrew March 15, 1917, $45; deposited April 24, 1917, $30; deposited November 4, 1917, $15; deposited January 2, 1918, $25; withdrew April 30, 1918, $40. Interest on the deposits was 4 per cent. per annum on the smallest amount on deposit during the interest period of six months. Interest dates were January 1 and July 1.

9. Mr. Baker had a balance in the bank on July 1, 1916, of $780 He withdrew December 1, 1916, $210; deposited January 1, 1917, $112; deposited April 7, 1917, $90; withdrew May 23, 1917, $110; deposited June 18, 1917, $174; deposited July 9, 1917, $45; withdrew August 23, 1917, $80; deposited November 3, 1917, $140. Assume that interest is computed at the rate of 4 per cent. per annum on all amounts that have been on deposit for 6 months or 3 months prior to the interest dates of January 1 and July 1.

10. Mary Greene opened a savings bank account on January 1, 1916, by depositing $5. Thereafter she deposited $5 each month. Find the amount of the principal and interest on July 1, 1918, if the rate of interest was 4 per cent. and was credited to her account on January 1 and July 1 on all amounts that had been on deposit for six months or three months prior to the interest dates.

11. Mrs. James wished to accumulate a fund with which to buy a sewing machine costing $50. In order to do this she deposited $2

a month in the savings bank, making the first deposit on March 1, 1916. What was her balance in the bank at the end of 25 monthly payments if the rate of interest was 4 per cent. and the interest was computed on the smallest amount in the bank for any quarter, and credited to her account on January 1 and July 1?

12. Mrs. Goodwin deposited $10 in the savings bank each month for 39 months for the purpose of accumulating a fund with which to buy a piano costing $400. If her first deposit was made November 1, 1914, what was the total amount of interest received on her deposits? What was the amount due her at the end of 39 months? Compute the interest as in example 11.

13. Make statements of the accounts in examples 7, 8, and 9, if the interest is allowed from the first of each month. Any withdrawal is subtracted from the amount on deposit at the beginning of the 6 months' interest period, thus cancelling the interest that would otherwise accrue. If the withdrawal during an interest period exceeds the amount on deposit at the beginning of that period, the excess is subtracted from the first deposit during the interest period, in each case cancelling the interest as before.

Building and Loan Associations

A building and loan association is a private corporation organized for the purpose of promoting systematic saving among its members, especially with the idea that these savings may be used for the purchase of homes. Provided the interests of the members are adequately protected by state laws, such associations offer reasonably safe investments.

A person may invest money in a building and loan association by paying monthly dues, usually of 25 cents, 50 cents, 75 cents, or $1 a month, for each share of stock that he owns. He then becomes a shareholder in the corporation. If the dues are $1 a month, the payment of $5 a month entitles him to 5 shares of stock.

When the dues paid in on any series of shares plus the dividends earned by these dues equals the face value of the shares, then the shares are said to have matured and a shareholder may withdraw an amount equal to the face value of his shares. The value of a share is usually $100 or $200, according as the dues are 50 cents or $1. Such shares mature in about eleven and one-half years.

In some associations if a member is unable to keep up his pay-

ments he may withdraw an amount equal to the total of the dues that he has paid plus a reasonable share of the profits. If this is not true, the interests of the investor are not sufficiently protected.

The funds of the association are loaned on mortgages or other securities for a fair rate of interest, and earn for the members an average of 5 per cent. to 7 per cent. interest on their investments.

EXERCISE V

Unless otherwise stated consider that a share in a building and loan association on which the dues are $1 per month is worth $200 at maturity.

Problem.—Part I. A man invested $20 per month in a building and loan association in which the dues were $1 per share per month, and the value of the matured shares was $200 each. What was his profit on the investment, if the shares matured in 11 years and 9 months?

$\$20 \times 12 \times 11\frac{9}{12} = \$2820$, the total amount paid into the association.

$\$200 \times 20 = \$4000$, the value of the matured shares.

$\$4000 - \$2820 = \$1180$, the profit on the investment.

Part II. If at the end of three years he had been unable to keep up his payments, how much would he have paid into the association? If he was entitled to profits at the rate of 4 per cent. per annum, how much could he withdraw at this time?

$\$20 \times 12 \times 3 = \$720$, the sum of his payments at the end of three years.

The first payment of $20 would have been invested for 36 months.

The second payment of $20 would have been invested for 35 months.

The last payment of $20 would have been invested for 1 month.

The interest on these payments would be the same as the interest on $20 for $36 + 35 + \ldots 2 + 1$ months. The series of numbers from 36 to 1 is an arithmetic progression and its sum equals $\left(\frac{36+1}{2}\right)36$ or 666. (The sum of the terms of an arithmetic progression equals ½ the sum of the first and last terms multiplied by the number of terms.)

$\$20 \times \frac{6}{1}\frac{6}{2} \times .04 = \$44.40$, the interest on $20 for 666 months, or the interest on his investment.

$\$720 + 44.40 = \$764.40$, the withdrawal value of his shares at the end of three years.

1. Mrs. Baxter owned 5 shares in a building and loan association in which the dues were $1 per month. The shares matured in 11 years and 5 months. How much did she pay into the association? What was her profit on the investment?

2. If Mrs. Baxter had invested her money in a savings bank paying 4 per cent. interest, compounded semiannually, what would have been the profit on her investment?

3. Mrs. Brown wished to accumulate a fund for the college edu-

cation of her daughter Mary. When Mary was 8 years old, Mrs. Brown bought 10 shares in a building and loan association in which the dues were $1 per month. If the shares matured in 11 years and 9 months, how much did she pay into the association? What was her profit on the investment?

4. Susan Center saved $2 a month, which she invested in shares in a building and loan association in which the dues were 50 cents a month. If the shares matured in 12 years, what was her profit on the investment?

5. If Susan Center deposited the money she received from these paid-up shares in a savings bank paying interest at the rate of 4 per cent. per annum, compounded annually, and then invested this interest in a new series of building and loan shares, what would be the total amount of her profits at the end of 11 years and 6 months when this series matured?

6. Ethel Baxter, a stenographer, receiving $100 a month, wished to accumulate a fund. She bought 15 shares in a series of building and loan association stock in which the dues were 75 cents per month and the face value of each share $100. If these shares matured in 9 years and 2 months, what was her profit? She continued the investment of her savings by taking 15 shares in a new series which matured in 9 years. She also invested the money which she had received from the paid-up shares of the first series in bonds paying 6 per cent. interest. With the interest from these bonds she bought shares in a third series which matured in 9 years and 4 months. What did her savings amount to at the end of this time?

7. How much must you save each week in order to pay for one share in the building and loan association in your town? Find out in how many years the share is likely to mature? About what will your profit amount to?

8. Sarah Baker received a legacy of $1000 which she invested at 6 per cent. interest. How many shares in a building and loan association at $1 per share could she buy with the interest on her investment? If the shares matured in 11 years and 4 months, what was the total profit on her investment?

9. Harold Brown owned 10 shares in a building and loan association in which the dues were $1 per month. After holding them for four years, he was taken sick and not only was he unable to keep up the payments but he needed the money to pay the expense

of his sickness. If he was entitled to profits at the rate of 4 per cent. per annum, how much did he receive for his share?

10. Mrs. Jones owned 12 shares in a building and loan association in which the dues were 50 cents per month per share. At the end of 6 years she was unable to keep up her payments. If she was entitled to profits at the rate of 5 per cent. per annum, what was the withdrawal value of her shares?

11. In March, 1908, Mary Brown purchased 10 shares in a building and loan association in which the dues were $1 per month. In September, 1916, she wished to borrow money from the association to pay for a year's work in a university. The cost of her course would be $900 and in addition to that she wished to keep up her dues in the association and pay the interest on her loan. If the withdrawal value of her shares was reckoned as the sum of her payments plus interest at 5 per cent. per annum and she was entitled to a loan of 90 per cent. of the withdrawal value of her shares, what amount could she borrow? Would this cover the expenses of the year, if the money was loaned at 6 per cent. per annum? How much did she pay per month in dues and interest after the loan was made? How much did she receive when her shares matured at the end of 11 years and 4 months if the matured shares were used to cancel her loan?

Stocks

A group of persons, organized under the laws of the state to do business as a single individual is called a corporation. If three men, for example, have $20,000, $30,000 and $100,000 which they wish to invest in some business which requires a capital of $200,000, they may find others who will furnish the additional capital required and form a corporation under the laws of the state to carry on the business. Then each man receives certificates of stock and becomes a stockholder in the corporation. The usual value of a share of stock is $100, though shares may have various values. In the example given above, the first man would receive 200 shares of stock and the second man 300 shares, etc.

The earnings of the company after deductions are made for a surplus fund, a sinking fund, etc., are divided among the stockholders. These earnings are called dividends. If a dividend of 3 per cent. is declared each stockholder receives $3 for each share of stock that he owns, provided, of course, that the par value of a share is $100.

Companies issue two kinds of stock, common stock and preferred stock. Preferred stock carries with it a guaranty to pay a specified dividend provided that the earnings of the company are sufficient to pay this dividend. The earnings that remain after these dividends are paid are divided proportionally among the common stockholders. For example, a man might hold 5 shares of preferred stock on which the rate is 8 per cent., and 5 shares of common stock. If the par value of each share is $100, he would receive $40 on the preferred stock provided there are sufficient earnings made by the company. On the common stock he might receive nothing or he might receive $20, $40, or $50, according as the dividends were 4 per cent., 8 per cent., or 10 per cent. It will be easily seen that the preferred stock is the safer investment, but not necessarily the more profitable.

The par value of a share of stock is the value stated on the certificate of stock. The market value is the price for which the stock can be sold. Daily newspapers give the market prices of the leading stocks. These prices are quoted as so many dollars on a hundred. For example, Reading stock, the par value of which is $50 a share, is quoted at 94. This means that a share is worth 94 per cent. of $50, or $47. The market value of stock depends upon many factors, of which the most important is the earnings of the company issuing the stock. Because of the fluctuation in their market value and the lack of guaranty of dividends, as well as for other reasons, stocks are not to be recommended for the small investor.

Quotations for Stocks, June 30, 1918

Am. Can. pf	94½
Am. Ice pf	50
Anaconda Copper	68
C. R. I. & P. pf	75⅞
Chi., Mil. & St. P. pf	74½
D. L. & W.	164½
Gen. Motors pf	81⅞
Great Northern pf	90¾
Louis. and Nash.	116½
Pac. T. & T. pf	90
Pittsburg Coal	53
Reading	92⅞
Union Pacific	122
United Drug 1st pf	49½
U. S. Rubber	59¼
U. S. Smelt., Ref. & M.	44¾
U. S. Steel pf	108⅛
Wells Fargo Exp.	75
Western Union Tel.	92

Stocks are usually purchased from a broker who charges $\frac{1}{8}$ per cent. of the par value of the stocks as a commission either for the purchase or selling of the stocks.

EXERCISE VI

Problem.—Find the cost of 25 shares of U. S. Steel, pf., including brokerage at the usual rate. The quarterly dividends are $1\frac{3}{4}$ per cent. What is the rate of interest per annum on the investment?

$\$108\frac{1}{8} + \$\frac{1}{8} = \$108\frac{1}{4}$, the cost of one share.
$25 \times \$108\frac{1}{4} = \$2706.25$, the cost of the 25 shares.
$4 \times \$1\frac{3}{4} = \$7$, the income of one share for one year.
$\$7 \div \$108\frac{1}{4} = .065$, or 6.5 per cent., the rate of interest per annum on the investment.

In the following problems use the quotations given in the previous list and consider the par value of one share of stock as \$100, unless otherwise stated.

Find the cost of the following, including brokerage at the usual rate:

1. 125 Am. Can. pf
2. 75 D. L. & W.
3. 150 Louis. & Nash.
4. 20 Pac. T. & T. pf
5. 235 Pittsburg Coal.
6. 235 Reading (par \$50)
7. 140 Union Pacific
8. 35 U. S. Rubber
9. 75 U. S. Smelt., Ref. & M.
10. 55 Western Union Tel.

11. Find the cost of 115 shares of Anaconda Copper. If the dividends for the year are \$8 per share, what is the rate of interest on the investment?

12. Find the cost of 50 shares of Wells Fargo Exp. stock. If quarterly dividends of $1\frac{1}{2}$ per cent. are declared, what is the income on the investment? What is the rate of interest per annum?

13. Which is the better investment, General Motors, pf, with annual dividends of 6 per cent., or Great Northern, pf, with quarterly dividends of $1\frac{3}{4}$ per cent.? What is the rate of interest per annum on each investment?

14. Find the cost of 25 shares of American Ice, pf, with brokerage at the usual rate. It pays a quarterly dividend of $1\frac{1}{4}$ per cent. What is the rate of interest on the investment?

15. A man sold 25 shares of C. R. I. & P. preferred stock, paying $3\frac{1}{2}$ per cent. semi-annual dividends, and invested the proceeds in C. M. & St. P. preferred stock paying 8 per cent. annual dividends. Was his income increased or decreased? Allowing for

brokerage, what did he receive for the shares that he sold and what did he pay for the C. M. & St. P. stock?

16. A man withdraws from the savings bank, paying 4 per cent. interest, enough money to pay for 10 shares of 6 per cent. stock at 110. What will be the increase in his income?

17. Find the cost of 55 shares of United Drug 1st pf. stock. What is the rate of interest per annum on the investment if it pays 87½ cents per quarter on each share?

18. A family that owned 15 shares of U. S. Steel preferred stock, paying 1¾ per cent. dividends, quarterly, invested the dividends in Building and Loan shares costing $1 per month. How many shares could they buy? What was the total profit on the investment at the end of 11 years when the shares matured?

Bonds

A government, a corporation, or even an individual, wishing to borrow money may issue bonds, which are promises to pay the amount borrowed at a time specified in the bond with interest at a fixed rate payable at stated intervals. Government bonds have back of them as security the wealth of the country, while corporation bonds are usually secured by mortgages on the property of the corporation.

Bonds are issued by the United States to provide funds for unusual expenses of the government, to build public waterways and public works of all sorts, and to equip the army and navy. Bonds are issued by cities, towns and villages to provide for civic improvements. They are also issued by public utility, railroad, and industrial corporations. Individuals, wishing to borrow money to pay for real estate, give bonds secured by mortgage on the real estate.

Bonds are known by the names of the government or corporation issuing them, the rate of interest they bear, and the date of maturity. For example, N. Y. City 4's, 1959, are bonds issued by the government of the city of New York, bearing 4 per cent. interest, and due in 1959.

Bonds, being secured by property, are one of the safest means of investing money. In buying bonds one should carefully consider the security back of them and the length of time before they mature. Bonds are redeemable at face value at maturity unless otherwise specified. Hence in buying bonds the date of maturity is a

factor in determining the per cent. of interest on the investment. On January 1, 1916, a man might pay $1100 for a bond for which he would receive only $1000 at maturity. If the date of maturity was January 1, 1918, and the rate of interest was 5 per cent., then the interest on the bond for the two years before maturity was $100 and was exactly equal to the loss in value of the bond. The rate of interest on the investment was practically nil. Banks use bond tables to determine the actual rate of interest on an investment in bonds, but these tables are too complicated for insertion here. In the following problems the rate of interest on the investment will be computed without regard to the date of maturity of the bond. If the bonds are bought when they are above par then the rate of interest computed by this method will be too high; if bought when they are below par, too low.

In buying bonds accrued interest is usually charged. For example, on April 1, a man wishes to buy a $1000 bond with interest at 4 per cent., payable semi-annually January 1 and July 1. If the bond is quoted at 92, he must pay $920 for the bond itself. The accrued interest is the interest on $1000 from January 1 to April 1 at 4 per cent. or $10. Hence the total cost of the bond on April 1 is $930.

Bonds usually have a par value of $1000, although some bonds have a par value of $500 or $100. The U. S. Liberty bonds are issued in denominations of $50, $100, $500, $1000, $10,000, $50,000, and $100,000, in order to attract the small as well as the large investor. The market value of bonds is quoted in the newspapers as so many dollars on a hundred. For example, a $1000 bond quoted at 72 would sell at 72 per cent. of $1000 or $720.

EXERCISE VII

Problem.—Find the cost of $3000 Northern Pacific 4's quoted at 79½ and bought March 12, if the interest dates are June 1 and Dec. 1. What is the annual income on the investment? What is the rate of interest per annum on the investment?

79½ per cent. of $3000 = $2385, the cost of the shares without accrued interest.

From Dec. 1 to March 12 is 3 months and 11 days.

Interest on $3000 at 4 per cent. for 3 mo. 11 days is $33.67.

$2385 + $33.67 = $2418.67, the total amount paid for the bonds.

4 per cent. of $3000 = $120, the annual income.

4 per cent. ÷ 79½ per cent. = .05, or 5 per cent., the rate of interest per annum on the investment.

In the following problems figure the brokerage at the usual rate of ⅛ per cent. of the par value of the bonds. Consider the par value of a bond as $1000, except in the case of U. S. Liberty bonds or when otherwise stated.

1. Find the cost of $5000 U. S. Liberty 4¼'s quoted at 96.7. What is the rate of interest per annum on the investment?

2. Find the cost, including accrued interest, of $15,000 So. Pacific Railroad 4's, bought May 23, if the interest dates are July 1 and January 1, and the bonds are quoted at 78. What is the annual income from the investment?

3. Find the cost of $7000 Adams Express 4's, including brokerage and accrued interest, bought July 12, if the interest dates are March 1 and September 1, and the bonds are quoted at 66¾.

4. A man sells 30 shares of 4 per cent. Norf. & Wash. preferred stock at 77 and buys U. S. Liberty 4¼'s at par. Does he increase or decrease his income?

5. Mabel Little invested in 15 shares in a building and loan association in which the shares have a par value of $200. When the shares matured she invested in Public Service Corp. 5's which were quoted at 80, and she then invested the surplus which remained after this investment in U. S. Liberty 4¼'s at par. What is the income from her bonds?

6. Mrs. Brown received from the settlement of her husband's estate $12,000 which she invested in N. Y. Central 6's quoted at 94¼. How much did the bonds cost her including brokerage at the usual rate? What is her annual income from the investment?

7. Mrs. Jones deposits $200 a year for 5 years in a savings bank which pays 4 per cent. interest annually. She withdraws part of these savings and invests them in two mortgages a $400 mortgage with interest at 6 per cent. and a $600 mortgage with interest at 5 per cent. What remains in the bank? What income does she receive from her investments?

8. How many shares in a building and loan association at $1 per month per share could Mrs. Jones buy with the income from her investments? When the shares matured ($200 matured value per share), what would be the total value of her investments?

9. A country school teacher found that she could save $150 a year. For three years she invested this money in a savings bank, which paid 3½ per cent. interest annually. Then she decided to

buy 4½ per cent. bonds of the Federal Farm Loan which were well secured by farm mortgages and also had the advantage of being issued in small denominations of $25, $50, and $100. How much could she invest in bonds? If she continued to invest in bonds, what income was she receiving from her investment at the end of 5 more years?

10. Margaret Jones, age 8, had a legacy of $700 left her in April, 1918. This her father invested in 4¼ per cent. Liberty Bonds, payable in 1928, which were being issued at that time. What was the yearly income on the investment? What would be the total amount of interest received if the bonds were kept until the date of maturity?

11. How many $200-shares in a building and loan association in which the dues were $1 per month per share could be purchased with the annual interest from these bonds?

12. The series in the building and loan association opened August 15. If the interest on the bonds was not received until September 15, how much would have to be paid for the shares in this series at that time to pay for the back dues, together with 6 per cent. average interest on the amount of the dues so paid in?

13. As the dues in the association amount to $12 a year or multiples of $12, there will be a surplus after investing the interest from the bonds in the building and loan shares. Will this surplus, which can be put in the savings bank, amount to enough to pay the dues after the Liberty Bonds mature on March 15, 1928, and the interest from them ceases? The $200-shares in the Building and Loan Association will mature in 11 years and 6 months after August 15, 1918.

14. What will the principal and interest on Margaret Jones' legacy of $700 amount to when the shares in the Building and Loan Association mature, if the money invested in the savings bank bears 4 per cent. interest compounded annually?

Life Insurance

If a man wishes to be sure that in the event of his death his wife or family will have a certain sum of money or a given income he may make a contract with an insurance company. The company agrees for a consideration specified in the contract to pay this money at the death of the man or at some stated time.

The consideration which the man pays is called the premium and is paid in equal installments, although it may be paid in one lump sum. These installments are usually paid annually or semi-annually. If the premium is payable weekly or monthly, as is often the case with workingmen's insurance, a higher rate is charged.

The person named in the insurance policy to receive the payment upon the death of the insured is called the beneficiary. The insurance may be paid to the beneficiary in one lump sum or in installments extending over a period of time.

There are many kinds of policies, but they may be classified in four groups: whole life policies, limited payment life policies, endowment policies, and term policies.

Whole life policies are those in which the face value of the policy is payable at death only. The premiums are payable annually during the life of the insured.

Limited payment life policies are those in which the premiums are payable annually for a stated period, at the end of which time the policy is paid up for the remainder of the life of the insured.

Endowment policies provide for the payment of the sum to the insured at a fixed date if he is then living. If he dies before that time, the sum is paid to the beneficiary at the time of his death.

In term policies the premiums are payable only during a stated term and at the end of that time the insurance ceases. The insurance is payable only in the event of the death during that term. These policies are often taken out to cover debts or some risk. The government insurance of soldiers is of this nature.

Insurance companies are obliged by state law to set aside a certain part of each premium in order to build up a reserve fund from which the death losses and maturing policies are paid. The amount to be set aside is computed from data supplied by the U. S. mortality tables and depends on the average expectation of life. These companies are known as legal reserve companies and are the only safe ones in which to invest. In all mutual companies the insured receives dividends from the earnings of the company, which may be used to reduce his annual premium. If payments are discontinued, the insured does not lose the total amount of his investment.

The following table shows the annual premium charged for $1000 of insurance on different kinds of policies and for different ages of

the insured by one insurance company. The younger a man is when he takes out a policy, the lower is the rate because his expectation of life is longer. Policies are usually issued in sums of $1000 or multiples of $1000.

Whole Life and Limited-Payment Life Policies. Annual premiums per $1000					Age nearest birthday	Endowment Policies. Annual premiums per $1000		
						Policy payable in		
Whole Life	10 Payment Life	15 Payment Life	20 Payment Life	25 Payment Life		15 years	20 years	25 years
$14.83	$36.62	$27.08	$22.43	$19.90	20	$57.83	$41.52	$32.07
15.15	37.20	27.52	22.80	20.23	21	57.88	41.58	32.14
15.49	37.80	27.97	23.18	20.57	22	57.94	41.64	32.21
15.85	38.42	28.44	23.57	20.93	23	57.99	41.71	32.29
16.22	39.07	28.92	23.98	21.30	24	58.05	41.78	32.38
16.61	39.74	29.43	24.41	21.68	25	58.12	41.86	32.47
17.03	40.44	29.95	24.85	22.09	26	58.19	41.94	32.57
17.46	41.16	30.50	25.31	22.51	27	58.26	42.03	32.68
17.92	41.91	31.06	25.79	22.94	28	58.34	42.12	32.80
18.40	42.69	31.65	26.29	23.40	29	58.43	42.23	32.94
18.91	43.50	32.26	26.81	23.88	30	58.52	42.35	33.08
19.44	44.34	32.89	27.35	24.38	31	58.62	42.47	33.24
20.01	45.20	33.55	27.91	24.90	32	58.74	42.61	33.42
20.61	46.11	34.24	28.50	25.45	33	58.86	42.76	33.62
21.23	47.04	34.95	29.12	26.03	34	58.99	32.93	33.83
21.90	48.01	35.70	29.76	26.63	35	59.13	43.12	34.07
22.60	49.02	36.47	30.43	27.27	36	59.29	43.32	34.34
23.35	50.06	37.28	31.14	27.93	37	59.47	43.55	34.64
24.13	51.15	38.12	31.88	28.64	38	59.67	43.81	34.97
24.97	52.27	38.99	32.65	29.38	39	59.88	44.09	35.34
25.85	53.44	39.91	33.46	30.17	40	60.13	44.41	35.75

EXERCISE VIII

Problem.—Find the annual cost of $5000 of insurance taken out at the age of 35 for each one of the following policies: (1) Whole life; (2) 10-payment life; and (3) 20-year endowment. If the man dies at the age of 50, how much would he have paid into the company on each one of these three policies?

(1) In the column entitled Whole Life Policy, opposite the age of 35, we find $21.90, the annual premium for $1000 of insurance.

$5 \times \$21.90 = \$109.50$, the annual premium for $5000 whole life policy.

50 years—35 years = 15 years, the length of time the policies are in force if the man dies at the age of 50.

$15 \times \$109.50 = \$1642.50$, the amount paid in 15 years on a whole life policy.

(2) $48.01 is the annual premium for $1000 ten-payment life policy.
$5 \times \$48.01 = \$240.50$, the annual premium for $5000 ten-payment life policy.
$10 \times 240.50 = 2045$, the total amount paid on a ten payment life policy.

(3) $43.12 is the annual premium for $1000 twenty-year endowment policy.
$5 \times \$43.12 = \$215.60$, the annual premium for $5000 twenty-year endowment policy.
$15 \times 215.60 = 3234$, the amount paid in 15 years on a twenty-year endowment policy.

In the event of his death at the age of 50, it will be seen that the whole life policy would be the cheapest of the three.

If he died at the age of 70, the total payments would have been as follows: on the whole life policy, $3832.50; on the ten-payment life policy, $2405; on the twenty-year endowment policy, $4312. At the age of 55 he would have received $5000 on the endowment policy. On the other two policies $5000 would be paid to the beneficiary at the death of the insured.

1. When John James married at the age of 24, he realized that he must in some way provide for the support of his wife and family in case of his death. So he took out a whole life policy for $10,000 with his wife as beneficiary. At the age of 65 he died. How much had he paid into the company? His wife invested the insurance received at his death in bonds paying 4½ per cent. interest on the investment. What is her annual income from this source?

2. Mrs. Burdick was left a widow at the age of 30. She had two children, 2 years and 3 years old. In order to provide for them in case of her death, she took out a 15-year endowment policy for $5000, planning to use the money for their education in case she lived to receive it. How much did she pay for the insurance, if she died at the age of 42? How much more did the children receive than she had paid into the company?

3. Mr. Jackson, a glass-blower, realizing that his earning capacity would be lessened after the age of 50, decided to take out a 25-payment life policy. If he took it out at the age of 23, how much did he pay annually for $3000 of insurance? If he died at the age of 56, how much had he paid into the company? If he had invested this money at 4 per cent., compound interest, what would it have amounted to at the time of his death?

4. The Association for Improving the Condition of the Poor in New York City gives $15 a week as the minimum income on which a widow and two children can maintain a normal living

standard. If the payment of $1000 of insurance to the beneficiary is made in installments instead of in one sum, it will provide a monthly income of $5.70 for a period of 20 years. What amount of insurance would be necessary to provide a widow and her family with an income of $15 per week? What would this cost per year if the insured were 33 years old when he took out his policy?

5. If the widow mentioned in example 5 preferred to receive the insurance in one sum instead of in monthly installments and invested this sum at the rate of 5 per cent., what would be her monthly income from this source? How much would she have to earn per week to keep the family income up to the minimum? If she could earn this amount, of what advantage would it be to her to have the insurance in one sum?

6. A man wishes to provide an income of $1000 for his family, in case of his death. At the age of 35 he insures his life for $8000, taking out a whole life policy. One thousand dollars of insurance will provide a monthly income of $5.00 or more for his wife during her lifetime, the exact amount depending upon her age when he dies. He takes out 30 shares in a building and loan association in which the shares are $1 per month per share. If he lives until after these shares mature, and can invest the amount received from them so that it will yield interest at the rate of 6 per cent. per annum, what will be the assured income of the family at his death? How much does the man pay per year for his shares and insurance during the period of his investment in the building and loan association?

7. Mary Brown, who is 20 years old, wishes to go to college. In order to do this she is obliged to borrow $1000 from her brother, expecting to pay it back after she finishes her 4 years' course. In order that her debt may be paid in the event of her death she takes out an endowment insurance policy for $1000 with her brother as beneficiary. At the end of 5 years after graduation she succeeds in paying her debt but decides to continue her insurance. At what age will her payments on the policy end? How much will she have paid into the company? What would you advise her to do with her insurance money if she is in good health at this time? If Mary had died at the age of 23, how much more would her brother have received than she had paid into the company?

8. Mr. Jones wishes to provide for setting his son up in business. When Fred is 5 years old and Mr. Jones is 34, he takes out a 15-year endowment policy for $2000. What does he pay in premiums if he lives until Fred is 20 years old?

9. Mr. Smith decides to provide $2000 for his son Harry, who is the same age as Fred Jones, by investing in building and loan shares at $1 per month per share. If these shares mature in 11 years and 7 months, how much does Mr. Smith pay into the association in dues? Which one of the fathers has made the more profitable investment? What are the advantages of each kind of investment?

10. Mr. Johnson, who is 51 years old, is buying a farm on the installment plan. Since he wishes to provide for the completion of the payments in case of his death, he takes out an insurance policy covering the mortgage on the farm which is $3000. The annual premium for $1000 is $26.17. If he dies at the age of 55, how much has he paid on his policy? How much more than this does his family receive?

11. Would you advise a husband to put all his savings into insurance? Give reasons for your answer.

12. If you have no one dependent on you in any way for support and no unsecured debts, would you invest in life insurance?

13. Under what conditions would you advise an unmarried woman to invest in life insurance?

14. A soldier in the United States Army was encouraged to take out government insurance for the period of the war and 5 years thereafter, paying a gradually increasing premium instead of the usual flat rate. During the continuance of the policy the soldier pays the premium specified for his age regardless of the age at which he first took out the policy. The rates are as follows:

Age	Monthly Premiums
20	$.64
21	.65
22	.65
23	.65
24	.66
25	.66
26	.67

During the first 4 years of the continuance of his policy, how much will a soldier pay in premiums for $5000 of insurance, if he takes out the policy when he is 22 years old?

15. A soldier 31 years old takes out government insurance, paying a monthly premium of 70 cents for the first year, 71 cents for the second year, 72 cents for the third year and so on for 5 years. Compare the cost to the soldier of a $10,000 government policy for 5 years with the cost to a civilian of a five-year convertible term policy in a commercial company at an annual premium of $8.84, if the policies are taken out when each of the insured is 31 years old. In the government insurance the United States Government assumes the burden of the extra losses due to war for which the commercial company would have to charge an additional premium.

16. In case of death the insurance is payable to the beneficiary in monthly installments of $5.75 for each $1000 of insurance until 240 monthly payments have been paid. For how many years will the monthly installments continue? What will be the total amount received in installments on a $6000 policy?

Annuities

A person wishing to provide a stated income for life, either for himself or for another, may do so by paying to the insurance company a certain sum of money. For example, a man at the age of 50, desiring an annual income of $1000 for the rest of his life, can obtain it by paying $13,516.50 to the insurance company. This sum of $1000 paid annually by the insurance company is called an annuity. The annuity rates for women are higher than the rates for men of the same age because the tables of mortality statistics of annuitants indicate that women annuitants live longer than men.

EXERCISE IX

1. At the age of 62 a farmer sold his farm for $8000 and moved into town. He invested this money in an annuity. If $1000 will buy an annuity of $96.64 at his age, what was his income from this source?

2. John Little, a bookkeeper, finds at the age of 70 that he can no longer continue his work. He has saved $5000. How large an annuity can he buy, if $1000 will purchase an annuity of $137.97?

3. A widower wished to provide an annual income of $650 for his daughter who had come home to keep house for him. How much would he have to pay if the rate at her age was $1785.65 per $100 of annuity?

4. Mr. Brown has an invalid daughter 25 years old for whom he wishes to provide a yearly income of $500. The rate for an annuity at her age is $2093.39 per $100. What will Mr. Brown have to pay for an annuity which will provide the desired income? How much money would he have to invest in bonds paying 6 per cent. interest to provide the same income?

5. Mary O'Donnell, a saleswoman 65 years of age, having savings amounting to $10,000, desires to retire from business. How much would she have to pay for an $800 annuity if the rate for her age is $998.87 per $100. If she invests the remainder of her savings in the savings bank, paying 4 per cent. interest, what will be her annual income?

6. Josephine Cook, a teacher, wishes to retire when she becomes 60 years old. How much ought she to save in order to provide for the cost of a $1200 annuity at that time, if the rate for a woman 60 years old is $1174.60 per $100?

7. Mrs. Allen was left a widow at the age of 65, at which time she received $13,000 from her husband's life insurance policies. She decided to invest $8000 of it in an annuity and the remainder in bonds paying 5 per cent. interest. If $1000 will buy an annuity of $100.11, what was her annual income from these investments? What is the advantage in not investing it all in an annuity?

Buying a Home

In order to buy a home it is not necessary to pay for it in cash. Various methods have been devised to aid those who wish to purchase property. The purchaser may borrow the money if he has securities; he may pay cash for part of the amount and borrow the balance on a mortgage on the property purchased; or he may pay on the installment plan.

In order to borrow money a man must have securities at least equal in value to the amount of money he wishes to borrow. The usual method of borrowing money for the purchase of property is by means of a mortgage. According to this method, the purchaser

pays a certain per cent. of the value of the property in cash and borrows the remainder, offering the property as security. If he fails to pay the interest within the specified time the property may be sold to pay the debt.

If the purchaser wishes to borrow an amount greater than 50 per cent. or 60 per cent. of the value of the property, he may sometimes secure a second mortgage for part of the balance, but he will have to pay a higher rate of interest because in case the property has to be sold to pay the debt, the claims of the person holding the first mortgage are satisfied first.

The borrower can usually arrange to pay off part of the mortgage, if he is able to do so, by making payments of part of the principal in addition to the interest. If he wishes to pay equal installments at stated intervals, a part of each installment is used to pay the interest and the remainder is applied in reducing the principal of the loan. This process is called amortization of the mortgage or "killing off" the mortgage. Buying on the installment plan is a common application of this method. The Federal Government has endorsed the method by adopting it in the Federal Farm Loan plan for helping farmers to buy their farms. Real estate companies frequently adopt this method of selling property, but they usually charge a high rate of interest. Many large corporations are encouraging their employees to purchase homes on the installment plan at a comparatively low rate of interest in order to induce the men to remain in their employ. Experiments in coöperative buying are being made which indicate that the rate of interest can be kept low if the stockholders are not only house-owners but owners and directors of the company, sharing in its protection and benefits.

One of the most successful methods of buying homes on the installment plan is the plan adopted by the building and loan associations. The purchaser pays cash for part of the property and takes out shares in the association whose face value is equivalent to the remainder due. He can then borrow from the association to the full amount of his shares and pay for his property, provided that he gives the association a mortgage secured by this property. For example, a man wishes to borrow $2000 to complete paying for a house and lot. He takes out 10 shares in a building association each with a par value of $200, payable at $1 per share per

month, and borrows from them $2000, giving them a mortgage on his property. He then pays interest on this loan and dues in the association until the shares mature. At that time his loan will be cancelled by the value of his matured shares, and his property will be free of debt.

Purchasers should find out the rate of interest they may have to pay before incurring debts. They should also reserve the privilege of reducing their debts either through occasional payments or through regular installments.

THE RELATION BETWEEN INCOME AND THE VALUE OF A HOME

EXERCISE X

1. A real estate man when asked how much a family could afford to invest in a home responded that the value of the home should be not more than twice the annual income. Show that this agrees with the budget allowance of 20 per cent. of the income for rent, provided 10 per cent. of the value of the property owned is allowed for interest on the investment, insurance, repairs, and depreciation.

2. A family has been paying $24 a month for rent. How expensive a house can they afford to purchase?

3. A family has an income of $1800 from the father's salary and in addition to this the interest on a $1000 bond at 4½ per cent. How much can they afford to invest in a home?

4. A family having a $2000 income wish to purchase a house and lot. How much can they afford to invest in this property? They plan to buy it on the installment plan, paying $550 a year, which is to cover the interest on the loan necessary to purchase the house, also the insurance, taxes, and upkeep, the remainder to be applied on the principal of the loan. Under what budget headings will you classify this expenditure, and how much will you put under each heading?

5. How much can a family having an income of $1500 from the father's wages and $200 from the mother's wages afford to invest in a home? If they can save $75 a year to invest in the home in addition to the budget allowance for rent, what can they afford to pay each year to cover all the expenses of shelter and a payment on the principal?

BORROWING MONEY TO PAY FOR THE HOME

The following table shows the amount of the annual payment to be made to cover both interest and an installment sufficient to pay off the principal of $1000 in the time stated, and at the rate of interest stated. Thus $129.50 a year will pay off a $1000 loan in 10 years, if the rate is 5 per cent.; the payment must be $135.87 if the rate is 6 per cent.

Amortization Table for $1000 Loan, Repayable in Equal Yearly Installments [2]

Term (years)	Amount of Annual Payment Including Interest at 5%	5½%	6%
10	$129.50	$132.67	$135.87
15	96.34	99.63	102.96
20	80.24	83.68	87.18
25	70.95	74.55	78.23
30	65.05	68.81	72.65
35	61.07	64.97	68.97
40	58.28	62.32	66.46

EXERCISE XI

Problem.—A family bought a house and lot costing $4000 from a real estate company. They paid $2000 in cash. For the remainder they gave a mortgage to the real estate company, reserving the privilege of paying off the mortgage in yearly installments. They decided that they could afford to pay $150 a year, part of which was to pay the interest on the mortgage at 6 per cent. and the remainder to apply on the principal. What remained to be paid at the end of 3 years?

6 per cent. of $2000 = $120, the interest on the principal for the first year.

$150 − $120 = $30, the amount to be applied on reducing the principal the first year.

$2000 − $30 = $1970, the new principal for the second year.

6 per cent. of $1970 = $118.20, the interest for the second year.

$150 − $118.20 = $31.80, the amount to be applied in reducing the principal the second year.

$1970 − $31.80 = $1938.20, the new principal for the third year.

Similarly the interest and the amount to be applied on the principal may be found for the third year. The result may be arranged in a table as below.

	Annual Payment	Interest on Balance	Payment on Principal	Principal Unpaid $2000.00
1st year	$150	$120.00	$30.00	$1970.00
2nd year	150	118.20	31.80	1938.20
3rd year	150	116.28	33.72	1904.48

[2] *Farm Loan Primer*, p. 10. Circular No. 5. Treasury Department. Federal Farm Loan Board. March 1, 1917.

Problem.—A farmer wishing to purchase a farm joined a Federal Farm Loan Association in order that he might get a loan of $3500 from a Federal Land Bank. As security for the loan he gave a mortgage bearing 5½ per cent. interest. How much must he pay each year in order to amortize the loan in 35 years? What will be the total amount of the interest paid during 35 years? If at the end of 5 years he finds he can pay off the mortgage, how much would remain to be paid?

From the amortization table,
$64.97 is the annual payment required to amortize a $1000 loan at 5½ per cent. in 35 years.
$3500 ÷ $1000 = 3½, the number of $1000 units in the loan.
3½ × $64.97 = $227.40, the annual payment.
35 × $227.40 = $7959, the total of the 35 payments.
$7959 − $3500 = $4459, the total amount of the interest paid during 35 years.

Using the method of the preceding problem to find out how much of the principal remains to be paid at the end of five years, the following results are obtained:

	Annual Payment	Interest on Balance	Payment on Principal	Principal Unpaid $3500.00
1st year	$227.40	$192.50	$34.90	$3465.10
2nd year	227.40	190.58	36.82	3428.28
3rd year	227.40	188.56	38.84	3389.44
4th year	227.40	186.42	40.98	3348.46
5th year	227.40	184.17	43.23	3305.23

$3305.23 remain to be paid at the end of the fifth year.

1. Mr. Jackson's home was burned. It was valued at $4500 and insured for 80 per cent. of its value. The building company agreed to erect a new house for him valued at $4800. He was to pay in cash the amount received from the insurance company and for the remainder he was to give the company a mortgage with interest at 5½ per cent. What was the yearly interest on this mortgage?

2. If the mortgage was payable in full at the end of 10 years, how much did he pay to the building company for the use of the money?

3. Mrs. Brown buys an 8-room house for $3500. She pays cash for 60 per cent. of the cost and gives a mortgage with interest at 6 per cent. for the remainder, reserving the privilege of paying off the mortgage in yearly installments. She allows 20 per cent. of her income of $1800 for shelter. Taxes, insurance, repairs, etc. amount to $100 a year. Does this leave anything to apply on the principal of the loan? She finds, however, that in addition to this amount she can save annually for this purpose 5 per cent. of her income. What will she pay for interest during the first three years if she reduces the principal each year?

4. A man bought a house and lot for which he paid the housing company on the following terms: Cash, 20 per cent. of the selling price; first mortgage bearing interest at 5 per cent., 50 per cent. of the selling price; second mortgage bearing interest at 5½ per cent., 30 per cent. of the selling price. The second mortgage was payable in 10 semiannual installments plus the interest. The cost of the house was $4200. How much did he pay the first two years in interest and principal? How much do you think that he could afford to pay annually on the principal of the first mortgage after the second was paid off?

5. A man bought a house and lot for $5000, paying cash, but the house was in poor repair and he had to pay $500 in order to put it into suitable condition for his family. To pay for the repairs he was obliged to give a mortgage on the property for $500, bearing interest at 6 per cent. He allowed this to run for 20 years. How much interest did he pay in that time? If he had paid the loan in 20 equal installments at 6 per cent. on the amortization plan, by how much would he have reduced the interest?

6. A farmer decides to buy a farm and pay for it according to the plan proposed by the Farm Loan Board. He can borrow from the bank according to this plan 50 per cent. of the appraised value of the land plus 20 per cent. of the value of the insured improvements. If his land is valued at $15,000 and the improvements at $5000, how much can he borrow?

7. If the farmer mentioned in example 6 borrows to the full amount that he is allowed, and plans to amortize the loan in 35 years, what will he pay each year? Show how much of the amount paid in the first three years applies on paying off the principal.

8. A farmer wishing to install on his farm an electric lighting plant, borrows $300 from a Federal Land Bank. He mortgages the farm according to the farm loan plan. How much interest at 5½ per cent. does he pay on an average each year if he pays off the mortgage in ten years? Compare this with a $300 mortgage bearing the same rate of interest and with the principal payable at the end of 10 years.

9. A man took out a mortgage on his farm August 31, 1894, for $300 at 10 per cent. After 8 years $100 was applied on the principal, and the rate of interest was changed to 8 per cent. The mortgage was cancelled by his widow December 27, 1917. Compute

the amount of interest that had been paid. On the amortization plan with interest at 6 per cent., what would have been the total amount of interest if they had amortized the principal in 25 years? How much less would they have paid by this plan?

10. A farmer found that the expenses connected with obtaining a loan of $1200 from a Federal Land Bank were $15 in fees and $65 for extra work on the abstract of the title which was required by the bank making the loan. Find the total cost of his loan if he paid it off in 35 annual installments.

11. A family wishes to install a water system in their country home costing $500, for which a mortgage is taken out on the property with interest at 5½ per cent. How much does the loan cost them if they amortize it in 20 years, and if the cost of clearing the title together with the other expenses of the loan amounts to $50?

12. Mr. Burdick found that he could purchase an 8-room house valued at $3200 on which there was a 6 per cent. mortgage of $1400. How much did he pay in cash? How much would he have to save each year to amortize the mortgage in 25 years?

13. If after 5 years Mr. Burdick finds that he can pay the remainder of the principal, how much will he have to pay? (This privilege of paying off the loan at any time after five years have elapsed is granted according to the federal loan system.)

EXERCISE XII

Problem.—A man buys a house costing $5000, paying $3000 in cash. He borrows the remainder from a building and loan association, giving them a mortgage with interest at 6 per cent. and takes out $200-shares to the amount of his loan. What must he pay each month into the association to cover interest on his loan and dues which are $1 per month per share? How much does he pay for his loan if the shares mature in 11 years and 6 months and his loan is cancelled at that time?

$5000 − $3000 = $2000, the amount of his loan.
$2000 ÷ $200 = 10, the number of shares of stock required to cover his loan.
10 × $1 = $10, dues paid per month for 10 shares.
½ × .06 × $2000 = $10, the interest paid per month on $2000.
11 years 6 months = 138 months.
138 × $20 = $2760, the total amount paid into the association.
$2760 − $2000 = $760, the cost of the loan.

1. John James is a bank clerk earning $30 per week. When he married he had saved $700 and his wife had saved $200. They invested their savings in a lot costing $300 and a house costing $2800. In order that they might borrow an amount sufficient to pay for the property they decided to buy shares in a building and loan association. In return for the loan the association accepted a mortgage on the property bearing interest at 6 per cent. How much must they pay into the association each month to pay the interest on this debt and to keep up their dues. If the series should mature in 11 years and 5 months, how much will they have paid for the use of the money? How much must they set aside each week? Under what budget heading would you include the interest on the mortgage? The dues in the association?

2. A young married couple decide that they would like to have a home. Although their income is only $1500 a year, they find by careful planning that they can save $10 a month. This they invest in 10 shares in the building and loan association with the idea that they will purchase a home when the shares mature. At the end of 11 years and 4 months when the series matures, they buy a house costing $3000 and pay for it in part with the money received from the matured shares. In order to pay for the house it is necessary for them to borrow the remainder of the money. They borrow it at 6 per cent. interest from a building and loan association and take out shares in a new series to cover their loan. How much do they pay into the association each month if the dues are $1 per month? How much of this is investment? How would you classify the remainder? How much do they pay for the use of the money if the series matured in 11 years and 7 months and their shares are then used to cancel their loan?

3. A workman's cottage was built by a company at a cost of $1500. The lot with improvements cost $500. The company expects 5 per cent. interest on their investment and they charge $25 a year for taxes and improvements. How much must the workman pay each year, according to the plan of amortization in order to own the property at the end of 30 years?

4. In order to secure the workman's family against loss, the company advises him to insure his life for the value of the property.

How much premium will he have to pay for a whole life policy if he is 28 years old? (See table on p. 214.)

5. The workman dies when he is 33 years old. How much will his widow receive from the insurance company? What amount will remain after she has paid the balance due on the property? What would you advise her to do with this?

6. A patternmaker earning $27 a week decides to buy one of the houses offered for sale by the company in whose employ he is working. The price of the property is $2250, to be paid for in monthly installments. For the first 5 years the monthly installment is $20.48; for the next 7 years, $13.25; and for the last 3 years, $6.91. In addition to these payments he estimates that he will have to pay for insurance, taxes, repairs, etc. 3 per cent. of the value of the property. At the end of 15 years, how much will the property have cost? What will be his average annual payment? He could rent the same house for $18.88 per month. How much would he have paid for rent during the same period?

7. In order that his family may not lose the property in case of his death, he decides to take out a life insurance policy. How much insurance should the patternmaker take out? What will be his annual premium, if he is 26 years old? Forty-five years old? (See table on p. 214.)

8. If he should die after he had made 8 annual payments on his house, how much would remain to be paid? How much would his widow receive from the insurance company? What would you advise her to do with the balance after paying for the house?

9. James Sullivan, an employee of the Goodyear Rubber Co., decides to buy one of the company's houses. The lot costs $75; the charge for improvements including grading, sewers, water, etc. is $165. The cost of the house is $1744. According to the plan, the monthly payments for the first 5 years are 1.1 per cent. of the cost; for the next 7 years, .65 per cent. of the cost; and for the last 3 years, .4 per cent. of the cost. How much must Mr. Sullivan set aside each month to meet these additional obligations? What is the total amount paid in 15 years? What is the yearly average? If his wages average $44 per week during this period, what should be the average budget allowance for shelter? How much does he invest each year in addition to the budget allowance for shelter?

Borrowing Money on Notes

A person sometimes finds it necessary to borrow money for a short period of time. If he has security for the amount he wishes to borrow, he can borrow it at a bank. He then makes out a paper promising to repay the money on demand or at a specified time. This paper is called a promissory note or simply a note. The note usually states the rate of interest to be paid, but, if it does not, the legal rate is charged. If the interest is paid at the time the loan is made the note is said to be discounted, that is, the borrower receives the face of the note less the interest.

Problem.—Mary Smith wishes to borrow $100 for 3 months to pay for a typewriter. She gives her note for $100 for 3 months with interest at 5 per cent. It is discounted at the bank. How much does Mary receive on the note?

Interest on $100 for 3 months at 5 per cent. is $1.25.
$100 − $1.25 = $98.75, the amount Mary receives on her note.

The Morris Plan Company is a company that loans small sums on notes for the period of 1 year or less. The loans are made on the character and earning power of the borrower and must be signed by two or more persons who hold themselves responsible for the payment of the note in case the maker of the note fails to pay it. A charge of $1 is made on each $50 of the loan or part thereof to cover the cost of investigation of the person desiring the loan, but no fee for this purpose exceeds $5. Interest at the rate of 6 per cent. per annum on the face value of the note is charged when the loan is made. To repay the loan the borrower is obliged to buy certificates of the company on the weekly installment plan equal in value to the amount of his loan. When the certificates are completely paid for they may be used in paying off the note.

EXERCISE XIII

Problem.—Find the cost of a loan of $150 for 1 year made by the Morris Plan Company to Thomas Jones. What amount does he receive on the note?

Amount borrowed	$150.00
Less interest at 6 per cent.	9.00
Less investigation charges at $1 per $50	3.00
Amount received	$138.00

The cost of the loan is $12.

1. In the above problem a loan of $150 for 1 year costs $12. What rate of interest did the borrower actually pay?

2. A girl borrowed $900 in order to complete her college education, offering her shares in a building and loan association as security for her loan. How much must she set aside each month to pay the interest on her loan at the rate of 6 per cent. per annum? If she paid her debt at the end of 5 years, how much interest did she pay?

3. A man was out of work for three months because of sickness. He was obliged to borrow $130 from the bank in order to pay his bills. He gave a note for 6 months with interest at the rate of 5½ per cent. per annum. How much did he receive on the note when it was discounted at the bank?

4. A girl on a farm wished to borrow $75 to start a canning business at home. She asked her father to indorse her note and she borrowed the money at the bank at 6 per cent. interest for 3 months. What did she receive on her note at the bank?

5. A young married man finds it necessary to borrow some money to buy the furniture for his home. He borrows $200 for 1 year from the Morris Plan Company. How much does the loan cost him?

6. A piano teacher wishes to buy a piano. She can buy it on the installment plan, paying $40 down and $20 a month for 20 months, or she can buy it for $380 in cash. What would you advise her to do, if she can borrow the money at 6 per cent. interest?

7. A school teacher is obliged to have an operation for appendicitis costing $125. To pay for this operation she borrows the money at the bank for 10 months, paying 6 per cent. interest on the loan. What does she receive on her note when it is discounted at the bank?

8. On March 1st a farmer borrowed $350 in order to buy some farm machinery. He gave his note bearing 6 per cent. interest. At the end of the first year he paid $150 on his note and the interest. At the end of the second year, $100 and interest. What remained to be paid at the end of the third year, including the interest? What was the total amount of interest paid?

HEALTH

Not all of the conditions essential to health can be controlled by the individual, but each can contribute in some measure to his own health by observing the laws of hygiene. Facts and figures with respect to health furnish an indication of the social condition of the community. The number of births, deaths, and marriages are collected and analyzed with varying degree of accuracy in all civilized countries. These vital statistics may be stated in terms of percentage, but are usually stated with reference to 1000 persons.

EXERCISE XIV

Problem.—**Find the 1918 death-rate per thousand in a town of 45,673 inhabitants where 835 deaths occurred during the year 1918.**

$835 \div 45{,}673 = .0183$
That is, the death-rate is 18.3 per thousand.

1. One hundred and twenty-nine deaths occurred in one year in a town of 8653. What was the death-rate per 1000? What per cent. of the population died?

2. Typhoid fever, due to impure water, caused 15 of the 95 deaths in 1917 in a town whose population numbered 3685. What was the death-rate per thousand from all causes? The death-rate due to typhoid fever?

3. If the average productive value of a life is $1700, what was the loss of productive value in this town due to typhoid fever?

4. It has been estimated that 40,000 deaths from pneumonia occur every year in the United States. What is the estimated loss to the country in productive value?

5. Through better methods of controlling diphtheria the death-rate from that disease in Massachusetts dropped from 13.5 per 1000 in 1880 to 2.4 per 1000 in 1908. In a community of 75,375 persons, how great a saving of life has been effected? How great a saving in estimated productive value? (See example 3.)

6. The death-rate in Massachusetts was 19 per 1000 in 1879, and it had dropped to 15 in 1911. In a town whose population is 43,688, what would the saving of life amount to in one year?

7. The death-rate due to accident in the registration area (*i.e.*,

districts in which vital statistics are recorded) in the United States was 6.63 per 1000 in 1880 and 9.79 per 1000 in 1908. At these rates how many more deaths from accident would occur in a city of 435,690 people in 1908 than in 1880.

GRAPHIC REPRESENTATION OF HEALTH STATISTICS

Charts are frequently used in health campaigns to make people realize the importance of fresh air, good food, sunshine, and good homes. When the facts are shown in picture form instead of in figures they tell the story at a glance.

EXERCISE XV

Problem.—Show how the following facts can be made to indicate at a glance that it is much safer for a baby to be born in Dunedin, New Zealand, than in any other place in the following list. The infant death-rate in the United States in 1910 was 12.4 per cent. of the infants born during that year; in St. Petersburg and Moscow, 1910, 28 per cent.; in Dunedin, 1907–1912, 6 per cent.; in Vienna, 1910, 17 per cent.; in Berlin, 1910, 15 per cent.; in Paris, 1910, 12 per cent.; in London, 1910, 10⅓ per cent.; in Glasgow, 1910, 14 per cent.

These statistics are shown graphically in the following chart:

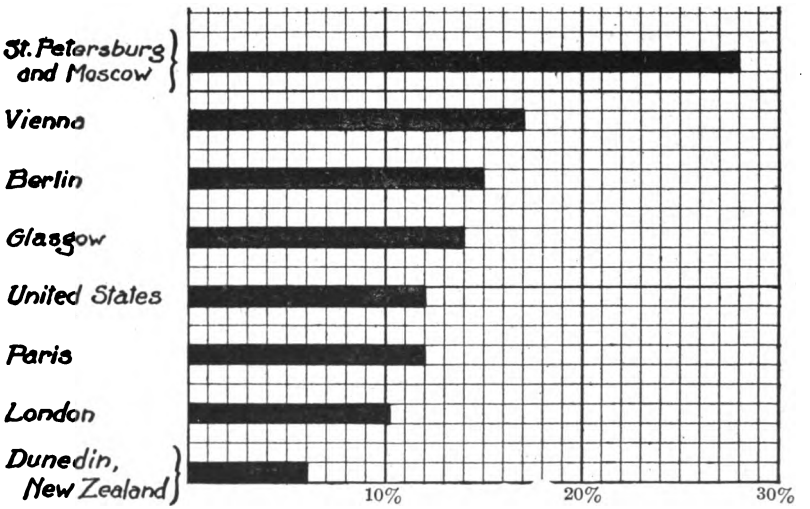

FIG. 37.—Infant death rate expressed in per cent. that number of deaths bear to number of births.

1. Use the following statistics to show by means of a chart that conditions are not so favorable to life in the "poorer" districts of a city as in the "better":

INVESTIGATION OF DEATH-RATE IN YORK, ENGLAND

Poorer section	Death-rate, 27.8 per 1000
Middle section	Death-rate, 20.7 per 1000
Highest section	Death-rate, 13.5 per 1000

2. Use the following statement from a report to show by a graph what an important factor sickness is in causing families to require financial aid: In a study of the causes of destitution it was found that relief was required in 21 per cent. of the cases because of the illness of the family breadwinner, in 18 per cent. of the cases because of the illness of some other member of the family. Miscellaneous causes accounted for the others.

3. Show by a chart the relative number of workmen who are seeking through membership in organizations such as labor unions, industrial benefit funds, etc. to provide against the loss of earning capacity caused by sickness. The total number of workmen in the United States in 1907 was estimated to be approximately 30,000,000.

SICKNESS INSURANCE FOR WAGE-EARNERS IN THE UNITED STATES, 1907.

Form of Organization	Number of Workmen covered
National unions	375,000
Local unions	100,000
Industrial benefit funds	55,000
Establishment funds	300,000
Railroad funds	300,000

4. Show graphically how relatively small an amount of money was spent in the prevention of disease in New York State in 1909 in comparison with the total expenditures for other purposes.

Total expenditures	$29,396,000
Expenditures for the State Board of Health.	146,980
Expenditures for the protection of game, fish, and forests	568,595

5. Show by a chart the need for improving health conditions as indicated by the following analysis of the reasons for rejecting men from the army:

ANALYSIS OF SOME OF THE CAUSES OF REJECTION OF MEN FROM THE DRAFTED ARMY BETWEEN SEPTEMBER 21 AND DECEMBER 7, 1917.

Cases of physical rejection considered..... 10,258

Causes of Rejection	No. of Cases
Alcoholism	79
Physical undevelopment	4,416
Teeth	871
Digestive system	82
Ear	609
Eye	2,224
Flat-foot	375
Heart	602
Tuberculosis	551
Under weight	163
Respiratory	161

6. Show graphically by means of two variables that the death-rate of infants under one year of age decreases as the father's income increases (see page 25).

MANCHESTER, N. H., STUDY OF INFANT DEATH-RATES. (U. S. Children's Bureau)

Father's earnings	Rate per 1000 of infant mortality
Under $494	261.1
$494–$571	172.2
$572–$675	186.3
$676–$883	151.1
$884–$1091	143.9
$1092 and over	58.8

(Let the side of each square to the right of the vertical axis represent $100 and let the side of each square above the horizontal axis represent a death-rate of 20 per 1000.)

7. Show graphically by means of two variables that poverty with its attendant evils has a definite relation to the chance a baby has of surviving the first year of life in Montclair, New Jersey. Use the following data of the U. S. Children's Bureau. First find an approximate infant mortality rate per 1000 by comparing the number of births with the number of deaths.

BIRTHS AND DEATHS UNDER 1 YEAR, ACCORDING TO TOTAL FAMILY INCOME

Total family income	Births	Deaths under 1 year
Under $625	95	11
$625 to $1199	111	9
$1200 and over	128	6

8. Show that workmen need to include in their budgets an allowance for sickness, and that the average amount of sickness varies according to the age of the worker.

AVERAGE LENGTH OF ILLNESS AMONG WORKERS IN LEIPZIG, 1856–1880

Age group	Average number of days of illness per year
15–20	40.9
20–30	50.2
30–40	57.4
40–50	68.6
50–60	83.3
60 and over	99.2

(The side of a square to the right of the vertical axis may be used to represent 5 years. The side of a square above the horizontal axis may represent 5 days of illness.)

9. Show graphically by means of two variables that the efforts to stamp out tuberculosis in Massachusetts have met with some measure of success.

DEATH-RATE IN MASSACHUSETTS FROM TUBERCULOSIS

Year	Rate per 1000
1880	29.1
1890	24.5
1900	18.0
1908	15.0

HEALTH INSURANCE

EXERCISE XVI

1. There are approximately 30,000,000 wage-earners in the United States. It has been estimated that they lose an average of 9 days each year on account of sickness. If the average wage is estimated at $2 per day, and the average cost of medical attention $1 per day, what is the total cost of sickness to the wage-earners?

2. Plans have been proposed for government compulsory health insurance for all wage-earners whose wages are less than a specified amount. According to one plan, the workman pays 25 cents per week, the employer 20 cents, and the government 5 cents. If disabled on account of sickness or non-industrial accident, the workman receives in addition to medical care, an allowance of $7 per week for not more than 26 weeks in one year, and in case of death

his family receives a death benefit of $100. How much would each workman be obliged to pay each year for health insurance?

3. Martin Snyder, a mechanic, earning $20 a week, was out of work 4 months on account of typhoid fever. If the government health insurance plan were in operation, how much help would he receive during this time?

4. Since Martin Snyder had no insurance of any kind, how much did his sickness cost him in loss of wages, doctor's bill for 10 calls at $1.50 per call, and medicine amounting to $2.85?

5. He might have taken out health insurance in a commercial company, paying an annual premium of $15.60 for a weekly indemnity of $7.50 and a death benefit of $200. How much would he have received during his disability?

6. Thomas Elwell, a bookkeeper on a salary of $90 a month, takes out health and accident insurance paying a premium of $11.40 per year for a policy that offers a weekly indemnity of $6.25 and a death benefit of $200. He carried this policy for 5 years and then decided to give it up. Two years later he suffered a compound fracture of one of his legs and was out of work for 6 months. What was the total cost of his sickness, if the doctor's bill was $85, cost of the nurse $18, cost of medicine $6.75? If he had continued to carry insurance, what would have been the total amount of the premiums for 7 years? The total amount of the indemnity he would have received?

7. Jane Ewing, an orphan entirely dependent upon her own resources, was employed as a stenographer at $75 a month. She decided to take out a health and accident insurance policy which would yield $200 in the case of death, and a weekly indemnity of $7.50 in case of illness. Such a policy costs $12 per year. She had appendicitis during the first year and was out of work for three weeks. During the fifth year she had scarlet fever and was out 6 weeks. How much did her insurance cost during the entire period? How much did she receive in indemnities from the company?

Beneficence

Every individual is responsible to some extent for securing better conditions not only for himself and his family but for the community—the state—the world at large. The effort to bring about

better living conditions means participation in group activities. Books for the whole community may be secured through public libraries to which each pays his part in taxes; care for the sick may be secured through a hospital supported either by taxation or by subscription; relief for those in want may be provided by individuals, by organizations, or by public funds.

No one is too poor to take thought for others and no one is so rich that he can live altogether to himself.

It is obvious that the opportunity for service increases as the income increases. Every one who has a larger income than the minimum amount required for sustaining life should include in his budget a definite allowance for service to others.

EXERCISE XVII

1. Mr. Miller's annual income is $875. If he is in the habit of giving a tithe (*i.e.*, a tenth) to the Lord, according to the Old Testament law, how much does he give each month?

2. Mary Morrison's salary was $15 a week. She pledged 10 cents a week to the church, 5 cents to Sunday School. She paid $1 a year to the National Child Labor Association, $1 a year to the Woman's Suffrage League, $5 to Red Cross, and $2 to the Relief Association. In addition to these pledges, she gave $2 to poor children at Christmas time. How much did she spend during the year in beneficence? Each week? What per cent. of her income does she spend for beneficence?

3. The amount needed for a certain church to meet its running expenses and to support the various activities of the church is $8000. Instead of relying upon voluntary offerings it was decided to divide this amount among the members who were self-supporting or were heads of families. There were 585 such persons in the church. What is each one's share?

4. It was proposed that a better plan for raising the $8000 would be to ask each to give according to his income. The estimated total income earned by the church members amounted to $756,990. If $8000 is to be raised, what would be the amount paid per $100? How much would a man be expected to give to the church if his income is $1294 a year? $2400 a year? $20 a week? $35 a week?

5. A local committee in charge of raising at least $50,000 for the Red Cross work estimated that incomes in the town amounted to approximately $5,000,000. If each person gave 1 per cent. of his income, how much could be raised? The committee estimated that 40 per cent. of the total income was earned by workers whose incomes are less than $1000 and who would probably not be able to give more than .5 per cent. of their incomes. If the others contribute 1.5 per cent. of their incomes, what will be the total amount contributed?

6. It was estimated that Detroit would be expected to contribute $7,000,000 in 1918 for war relief, social service, and general charity purposes. Instead of raising the money for each fund separately, it was decided to raise it all at one time through one central committee and apportion it to the various organizations according to the wishes of the givers. The following schedule of donations was proposed:

Under $5000	2 per cent.
$5,000 to $10,000	3 per cent.
10,000 to 20,000	4 per cent.
20,000 to 50,000	5 per cent.
50,000 to 75,000	6 per cent.
75,000 to 100,000	8 per cent.
100,000 to 200,000	10 per cent.
300,000 and over	15 per cent.

According to this table how much would a family with an annual income of $1200 be expected to give to the Patriotic Fund? An annual income of $60,000? Of $25,000? Of $125,000? How much would a person be expected to give whose weekly wage is $18? $25? $40?

Education

The importance of education is indicated by the fact that parents are required by law to send their children to school. It is not possible to estimate the value of an education either to the community or to the individual because there is no satisfactory way of measuring mental growth and power. But it is interesting to note that increased training frequently results in increased earnings.

The woman's club in a small town in Tennessee were trying to arouse interest in the need to improve their own town. For this purpose they used the following poster:

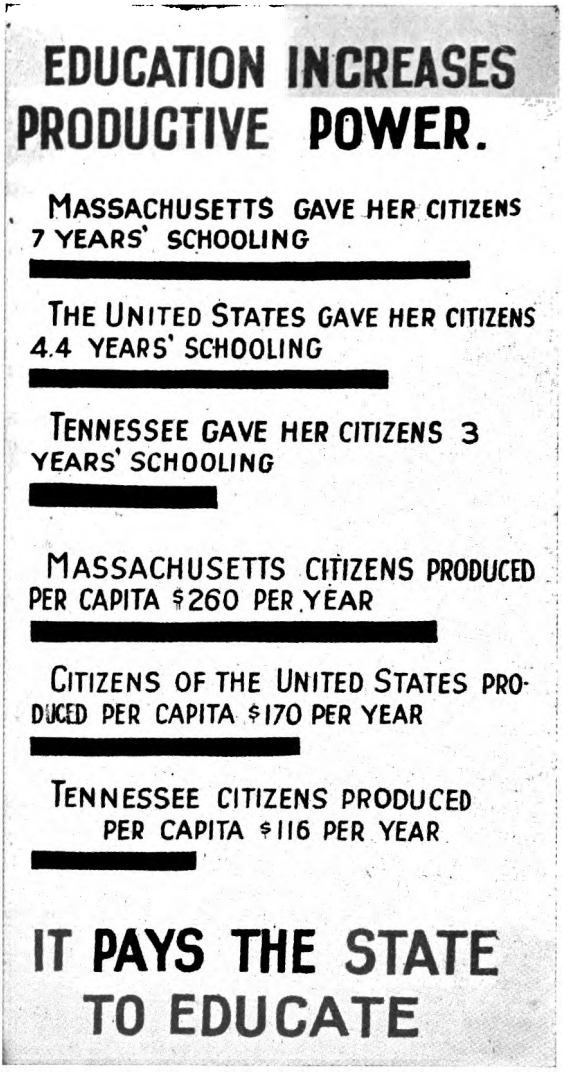
EDUCATION INCREASES PRODUCTIVE POWER.
MASSACHUSETTS GAVE HER CITIZENS 7 YEARS' SCHOOLING
THE UNITED STATES GAVE HER CITIZENS 4.4 YEARS' SCHOOLING
TENNESSEE GAVE HER CITIZENS 3 YEARS' SCHOOLING
MASSACHUSETTS CITIZENS PRODUCED PER CAPITA $260 PER YEAR
CITIZENS OF THE UNITED STATES PRODUCED PER CAPITA $170 PER YEAR
TENNESSEE CITIZENS PRODUCED PER CAPITA $116 PER YEAR
IT PAYS THE STATE TO EDUCATE

FIG. 38.—Education increases productive power.[3]

[3] *Money Value of an Education.* Bulletin No. 22, 1917. Department of the Interior. A. Caswell Ellis.

EXERCISE XVIII

1. Devise a poster to be used in a campaign for increased trade and technical education in your town, using the figures in the following table:

THE VALUE OF AN EDUCATION TO FACTORY WORKERS

Average annual earnings of men employed in several factories classified according to the education of the worker.

Technical school graduate (at 32)	$2150
Trade school graduate (at 25)	1200
Shop apprentice (at 16)	510

2. Make a chart for the purpose of showing the desirability of keeping children longer in school. Use the figures in the following table:

The average earnings of children who left the Brooklyn schools at 14 and of those who left at 18 are given for the period of 7 years.

Number of years after leaving school	Weekly wages of children who left school at 14	Weekly wages of children who left school at 18
1.	$4.00	—
2.	4.50	—
3.	5.00	—
4.	6.00	—
5.	7.00	$10
6.	9.50	15
7.	12.75	31

3. The average total wages received by a typical boy in each of the two groups by the time he was 25 years old was $5112.50 and $7337.50 respectively. What is the difference between the two totals?

4. The following table gives the average wages received by young men before entering the Baron de Hirsch School and when they leave after 5½ months' training. Find the per cent. of increase in wages for each trade and make a chart to illustrate the results:

Trade	Average weekly wage before entering	Average weekly wage after leaving
All trades	$6.00	$7.28
Machinists	6.66	8.96
Carpenters	6.14	9.01
Electricians	5.76	7.12

5. Tony's father was dead and his mother was earning $8 a week as a laundress. There were three younger children. Since Tony was 14 he planned to leave school to go to work as a messenger boy at $6 a week, a job which offered him no opportunity for advancement. A scholarship committee offered to lend him $5 a week without interest to be paid his mother while he went to trade school for 2 years. At the end of two years he took a job at $12.50 a week with promise of a raise of $3 every 3 months for a year. How much money did he borrow? How much did he earn during the first year at work? How would you advise him to repay the loan?

6. A girl 17 years old wished to become a trained nurse. She could not enter the hospital training course until she was 20, and so she decided to go to work in order to pay in part for her education. The only charge for the nurses' course was $50 in tuition for the first year in addition to the cost of uniforms during the probationary period, estimated at $25. She estimated that her personal expenses during the time of training would average $10 per month, and that she would need to allow $25 each year for her month's vacation. How much did she need in order to carry out her plan for a three years' course of training? If she saved $75 by the time she was 20 years old, how much did she have to borrow to pay for her training? If she took out a 20-year endowment policy for $1000 to provide for the payment of her debt in case she should die, what was the annual premium? If her average weekly wage for the three years previous to training was $11.35 and her average annual wage for the first 3 years after training was $914, how much did she gain a year by her additional training?

7. How much would it cost to keep a girl in high school from the time she is 14 until she is 18 years of age? Estimate the cost of board and room in her own home, the cost of clothes, car fare, class dues, books, stationery, and incidentals. Include the loss of wages at $5 a week which she might earn during the first year, $6.50 the second year, and $8.50 the third and fourth years.

8. Estimate the cost of your own education in the last 2 years. Include car fare, lunches, books, laboratory fees, stationery, tuition, and the approximate value of your board and room. If you go to public school include the estimated cost per pupil. (In Schenectady, N. Y., the cost per pupil in 1914 was $49.18, and in 1915 it was $60.62.)

9. The O'Briens are determined to have their children—James, aged 8, and Anne, aged 6—go to college as soon as they are old enough. It will cost $580 a year apiece for 4 years. What amount must be laid aside for this purpose. If Mr. O'Brien decides to save the money by investing in Building and Loan shares, how many $200-shares at $1 per month must he buy? If, on the other hand, he decides to invest the savings for this purpose in the savings bank paying 4 per cent. compound interest, how much must they save each year in order to have the necessary amount at the end of 12 years?

10. The estimates for the cost of a year in the College of Practical Arts, Teachers College, Columbia University, are as follows:

Items	Low estimate	Medium estimate
Room, board, laundry	$151.25	$327.00
College fees	100.00	277.00
Courses, books, supplies	.58	3.50
Clubs	.50	1.50
Social	2.00	8.60
Recreation	5.00	24.00
Car fare	2.25	9.85
Postage	2.48	8.65
Gifts, religious offerings	3.00	30.15
Health	.07	8.25
Personal	.50	4.48
Miscellaneous	2.00	14.90
Clothing	57.20	195.13

Make a budget for a girl in your own school who is going to Teachers College with an allowance of $725 a year including travelling expenses to New York. Make a similar budget for a girl who can spend $600. Make a clothing budget for each of these girls.

Recreation

All work and no play
Makes Jack a dull boy.
All play and no work
Makes Jack a ragged shirt.

Play cannot be left out of any plan for right living. Play or recreation varies with the age and taste of the individual. What is work for one is play for another. Some kinds of recreation are costly, some may be had for nothing. But the daily schedule must allow free time for recreation, and the family income is not adequate if there is not enough money to provide at least a small expenditure for pleasure.

Recreation adds a zest to life. It keeps mind and body alert and vigorous. The boy who does not play is father to the man who loafs.

The following table gives the cost and approximate life of the equipment needed for various sports. The prices are subject to variation, and should not be used unless current local prices are not available:

EQUIPMENT FOR SPORTS

Equipment	Cost	Life of equipment
TENNIS		
Racket	$3.00 to $5.00	Several years with care
Balls	.35 to .55	One season
Net	3.50 to 7.50	Several years
Portable marking tapes	5.00 to 8.00	Several years
GOLF		
Clubs (necessary):		
1 putter	$2.00 to $3.50	Years with care
1 mashie	2.00 to 3.50	Years with care
1 brassie driver	2.00 to 5.00	Years with care
Bag	1.35 to 12.00	Years with care
Balls	.35 to 1.00	One season or so
BASEBALL		
Bat	$.50 to $1.50	Several seasons
Ball		
Indoor (playground)	1.50	One or two seasons
Outdoors	.25 to 1.50	One or two seasons
Mit and gloves	.50 to 5.00	Several seasons
VOLLEY-BALL		
Ball	$3.50 to $6.00	Several seasons
Net	2.25	Indefinite
Standard posts	18.00	
CROQUET		
In sets of 4 to 8.	$3.50 to 6.50	Indefinite
SWIMMING		
Suits (without skirts)	$1.75 to $5.25	Several seasons
Suits (with skirts)	2.25 to 7.00	Several seasons
Diving cap	.25 to .75	One season
BOATING		
Canoes	$40.00 up	Indefinite
Paddles	1.50 up	Indefinite
Rowboats	30.00 up	Indefinite
Oars	2.00 up	Indefinite

FIELD HOCKEY

Equipment	Cost	Life of equipment
Sticks	$2.50 to $3.50	Indefinite
Balls	1.00 to 2.50	Indefinite
Field hockey goals	can be made at home at nominal cost	
Shin guards	1.00 a pair (not necessary)	

HIKING

Packs	$1.00 up	Indefinite
Cooking utensils:		
Frying pan	.15 up	Indefinite
Drinking cup	.10 up	Indefinite
Knife and fork	.10 up	Indefinite

BASKET-BALL

Basket-ball	$6.00 to $8.50	Several seasons
Basket-ball goals, pair (including nets)	5.00 to 7.50	Indefinite

SKATING

Skates	$2.50 up	Indefinite
Skates, on shoes	5.00 up	Indefinite

ROLLER SKATING

Skates	$2.50 to $5.00	Indefinite

ICE HOCKEY

Hockey sticks	$.50 up	Indefinite
Pucks	.50 up	Indefinite

SNOWSHOEING

Snowshoes	$7.00 up	Indefinite

SKIING

Skiis	$1.75 up	Indefinite

EXERCISE XIX

1. Assuming that there is opportunity for organizing sports either in public parks, playgrounds, or on unused land, estimate the total cost of the equipment for a group of 10 girls who wish to play tennis.

2. A high school girl plans to play tennis, to swim, to play field hockey, and to skate for the 4 years she is in school. What is the minimum cost of her equipment, omitting the cost of such apparatus as goal posts, tennis nets, etc.? What is the cost per year?

3. What would it cost to buy the necessary equipment for golf? A girl plays golf on an average of once a week for 8 months of the year. She breaks her brassie driver and has to replace it. She uses 1 dozen balls. What is the cost of her equpiment? If she plays

FIG. 39.—Camp-fire grate.[4]

golf four years, 3 afternoons a week for 7 months of each year, and if she buys 1 dozen balls each year, what is the average cost of her equipment per afternoon?

4. A neighborhood club is organized for outdoor sports. They

[4] From the *Report of the Board of Park Commissioners of Minneapolis*, 1917.

decide to purchase during the first 5 years, a croquet set, a tennis net, a volley ball, a net, and a set of standards for volley ball, field hockey goals, 2 basket balls and a set of goals. What is the total cost of the equipment? If an outlay of $3 per year will keep the equipment in repair for 5 years, what is the average annual budget for equipment?

5. Make a plan for outdoor sports for each season of the year for a club of girls in your community. Estimate the cost of the equipment that would be owned by the club, and the cost of the equipment that each girl would need to buy for her own use.

6. Make a clothing and recreation budget for one year for a girl who is going away to school where she will have opportunity to participate in tennis, swimming, field hockey, basket ball, hiking, baseball, and skating. Her allowance for clothing and for recreation is $30 per month.

7. It was estimated that in Southern mill-towns in 1910 an income of $126.84 was required to keep a boy of 16 or 17 years supplied with the essentials for living. Of this amount $7.80 was allowed for recreation. What per cent. is this of the total amount? Make a budget showing how you would advise spending this allowance for recreation.[5]

8. According to the same study, a family consisting of 4 persons could subsist on the following allowance: Father, $146.82; mother, $117.; girl of 16 or 17, $140.40; boy 16 or 17, $126.84. What was the total family budget? If $7.80 was allowed each for recreation, what per cent. of the family income was allowed for recreation? Make a budget showing how you would advise spending the family allowance for recreation.[5]

9. A girl whose monthly allowance was $2.50 made the following expenditures: Gum, 10 cents; movies, 70 cents; sundaes, 45 cents, *Saturday Evening Post,* 5 cents; dance, 50 cents; and candy, 15 cents. What per cent. of her allowance did she spend for recreation? Criticize the items with reference to their recreational value. Make out an itemized list of the expenditures you would make if you had $2.50 a month to spend for recreation.

10. If a high school girl spends 5½ hours in school, 9 hours sleeping, 2½ hours at meals, 3 hours studying, 1 hour with helping

[5] *Financing the Wage-Earner's Family.* Scott Nearing. B. W. Huebsch, N. Y.

with the house work, 1 hour going to and from school, how much time remains for recreation? What per cent. of her time is spent in recreation?

11. A play census of the children in Cleveland was taken June 23, 1913. The results were as follows:

WHAT 14,673 CLEVELAND CHILDREN WERE DOING ON JUNE 23, 1913 [6]

		Boys	Girls	Total
A. Where they were seen	On streets	5,241	2,558	7,799
	In yards	1,583	1,998	3,581
	In vacant lots	686	197	883
	In playgrounds	997	872	1,869
	In alleys	413	138	551
B. What they were doing	Doing nothing	3,737	2,234	5,961
	Playing	4,601	2,757	7,358
	Working	719	635	1,354
C. What games they were playing.	Baseball	1,448	190	1,638
	Kites	482	49	531
	Sand piles	241	230	471
	Tag	100	53	153
	Jackstones	68	257	325
	Dolls	89	193	282
	Sewing	14	130	144
	Housekeeping	53	191	244
	Horse and wagon	89	24	113
	Bicycle riding	79	13	92
	Minding baby	19	41	60
	Reading	17	35	52
	Roller skating	18	29	47
	Gardening	13	14	27
	Caddy	6	0	6
	Marbles	2	0	2
	Playing in other ways, mostly just fooling	1,863	1,308	3,171

Represent Graphically:

A. The relative number of children found in the various kinds of places.

B. The relative number of children engaged in the specified activities.

C. The relative popularity of the types of play observed.

[6] *Education Through Recreation.* George E. Johnson. Cleveland Foundation Survey Committee, Russell Sage Foundation, New York.

12. An investigation in 14 cities shows that of 33,122 children, 45 per cent. were loafing outside of school because, as they said, there was "nothing to do." How many children in these cities were not gaining the benefit of play?

13. In these same cities, 43 per cent. of the children were in the streets and alleys, 24 per cent. in private yards, 7 per cent. in vacant lots, and 4 per cent. in public playgrounds; the others were unaccounted for. Find the number of children in each place.

14. Of 23,765 children in schools of different neighborhoods in Milwaukee, Cleveland, Kansas City, Detroit, Providence and other cities, 52 per cent. were "doing nothing" outside of school hours. How many children in these cities were acquiring the habit of loafing?

15. In Galesburg, a city of 25,000, it is estimated that not counting Saturday afternoons, Sundays and holidays, and not considering the enormous amount of free time of women and children, the average citizen enjoys 5 hours of free time each day. If this is true, how many hours are available for recreation for all the citizens per day? Per week? Per year? Suggest ways in which the city might provide for the utilization of this leisure time in wholesome recreation. If each person spent on an average of one cent per hour for recreation, how much money would be spent on recreation in Galesburg per day? Per year?

16. Make out a daily time schedule for yourself. A weekly time schedule.

17. The expenditures made in one year by the Minneapolis Board of Park Commissioners for repairs and maintenance of the park and recreation facilities having direct relation to recreation was as follows:

Recreation	$22,806
Music	15,612
Flowers	7,761
Winter sports	15,898
Picking up refuse	2,844
Trees and shrubs	9,641
Lawn	20,676

Illustrate graphically the relative amount spent for each of these items.

18. It is estimated that the total annual amount of money spent in Minneapolis for commercial recreation is $600,000. The population is estimated to be about 400,000. What is the average amount of expenditure per capita?

19. In the city of Minneapolis in 1918 the cost of repairs and maintenance for the city parks and recreational facilities, including school playgrounds, public parks, baths and public playgrounds was $322,000. If the population was about 400,000, what was the outlay per capita?

20. Find the average outlay per capita allowed in the recreation budgets in each of the following cities, and illustrate the results graphically:

City	Population	Budget
Milwaukee	428,002	$103,000.00
St. Paul	241,999	8,825.00
Philadelphia	1,683,664	138,745.46
Oakland	190,803	132,302.94
Detroit	554,717	299,355.00
Grand Rapids, Mich.	125,759	8,341.50
Fort Worth, Texas	99,528	21,892.00
Williamstown, Mass.	3,981	3,524.53

21. Boating on two of the Minneapolis lakes cost the Park Commission $9467 for operation and repairs. The revenue from rentals for row-boats, sail-boats, canoes, launches, fish poles, and bait was $13,613. Find the net revenue to the city.

22. The cost of operating the public bath houses in Minneapolis for one season was $13,660. The total attendance was 243,330. What was the average cost per capita?

23. If the total receipts for bathing amounted to $13,566, what was the amount contributed from the city funds?

24. The total tax rate in Minneapolis for 1919 was 45.91 mills. The rate for parks and playgrounds was 1.48 mills. If property was assessed at approximately $224,000,000, what was the total amount raised for all expenses, and the amount raised for parks and recreation?

25. The distribution of each dollar of the money raised by taxation in Minneapolis for the various objects of expenditure is stated in the following table. Represent graphically the relation between the amount spent for recreation and for the other items:

Purpose	Cents
Fire Department	4.7
Health Department	.4
Police Department	3.1
Street lighting	2.0
Garbage collection and distribution	.6
Current expenses	3.6
Board of Charities and Correction	5.7
Cleaning streets	4.1
Playgrounds and museums	3.2
Library	2.0
Pensions and miscellaneous	1.8
Board of Education	27.7
State and County taxes	19.3
Investment, interest, etc.	21.8

26. The number of persons in a city per acre of park space is stated in the following table. Find the part of an acre available for recreation per person in each of these cities, and illustrate graphically:[7]

Cities	Population per acre of parks and grounds in and outside city limit
Chicago, Ill.	627
Boston, Mass.	203
Buffalo, N. Y.	467
Cleveland, Ohio	302
Detroit, Mich.	549
San Francisco, Cal.	217
Minneapolis, Minn.	116
Denver, Col.	68
Knoxville, Tenn.	7641
Passaic, N. J.	659
Dayton, Ohio	1391
Milwaukee, Wis.	436
Portland, Ore.	243

27. From the following table find the average population per acre in each of the cities and show by means of a graph the relative density of the population. What bearing has this upon the opportunity for recreation?

POPULATION AND THE AREA OF CERTAIN AMERICAN CITIES[7]

Cities	Population	Acres
New York, N. Y.	5,468,190	183,555
Chicago, Ill.	2,447,845	125,717
Los Angeles, Cal.	489,589	184,457
Newark, N. J.	399,000	14,858
Jersey City, N. J.	299,615	8,320
Portland, Oregon	292,278	37,555
Augusta, Me.	49,848	6,196
Lincoln, Neb.	45,900	4,988

[7] *General Statistics for Cities*, 1916. U. S. Census.

28. The amounts spent for public recreation in the five largest cities in this country are given in the following table. What is the average expenditure per capita? Represent the per capita expenditure graphically:

City	City expenditures	Population in 1915
New York	$6,148,144.00	5,468,190
Chicago	3,879,734.00	2,447,845
Philadelphia	2,446,201.00	1,683,664
St. Louis	848,940.00	749,183
Boston	1,667,466.00	746,084

29. During the war several cities undertook to carry on recreational activities financed by contributions. After the signing of the armistice it was proposed to transfer the support of these activities to the city. In one city the estimated budget for recreation was $8975. If the property was assessed at $5,380,000, find the amount by which the tax rate would have to be increased to meet this new item.

30. What tax should be levied to raise a budget of $32,500 for recreation, if the property is assessed at $463,000,000?

31. What would be the tax rate on an assessed valuation of $44,800,000?

32. What is the population of your own community? The area? The area of park space? The tax rate? The tax rate for recreation? The assessed valuation of the taxable property?

33. From the data in the preceding problem, find (*a*) the number of persons per acre in your community; (*b*) the part of an acre of park space per person; (*c*) the total amount of the tax levy; (*d*) the total amount of the tax levy for park maintenance and public recreation.

34. Illustrate graphically the comparison between your community and the cities in the preceding tables with reference to one or more of the above items.

APPENDIX

APPENDIX

Supplementary Work in Equations and Proportion

Equations

The Use of a Letter to Represent a Number in Solving Problems

In the solution of problems it is often convenient to use a letter to represent a number. Thus, if d were used to represent a dozen, or 12 units, 3d would represent 3×12 or 36 units. The statement that three dozens is equal to 36 units can be expressed as follows: $3 \times d = 36$, or briefly, $3d = 36$.

It is clear that there is a gain in brevity. But that is not all. Suppose that the value of the number represented by the letter m is not known, but the fact is known that 8 times the number represented by m equals 128. This may be stated

$$8m = 128$$

It is evident that $m = \frac{1}{8}$ of 128 or 16.

Proof: $8 \times 16 = 128$

A mathematical statement that two quantities are equal is called an equation. Thus $8 \times 16 = 128$ is an equation. When letters are used to represent numbers, this equation would be stated as follows: $8 \times m = 128$, or more briefly $8m = 128$.

The quantity on the left side of the equality sign is called the left-hand member, that on the right is called the right-hand member of the equation.

An equation is like a balance. Scales balance when the weights on the two arms are exactly equal. The scales will still balance if we add the same weights to both sides, subtract the same weights from both sides, double, treble, etc., the weights on both sides, halve, trisect, quarter, etc., the weights on both sides.

Stated mathematically, the operations that can be performed on an equation without changing the balance, are given in the following axioms:

(*a*) Equals may be added to both members of an equation without destroying the equality.

(*b*) Equals may be subtracted from both members of an equation without destroying the equality.

(*c*) Both sides of an equation may be multiplied by the same number without destroying the equality.

(*d*) Both sides of an equation may be divided by the same number without destroying the equality.

EXERCISE I

Problem.—Seven times a certain number is 63. Find the number.

Let $x =$ the required number.
Then $7x = 63$.
Divide both members of the equation by 7.
Then $x = 9$, the required number.
Proof: $7 \times 9 = 63$.

Find the value of the number represented by the letter in each of the following equations, and prove your answer:

1. $7x = 42$
2. $11n = 198$
3. $492 = 4y$
4. $16x = 80$
5. $15x = 75$
6. $118 = 4n$
7. $73 = 7x$
8. $114 = 2x$
9. $29x = 597$
10. $3x = 2$

EXERCISE II

Problem: Solve for n

$$\frac{n}{6} = \frac{5}{2}$$

Multiplying both members by 12, the lowest common multiple of the denominators and canceling,

$$\frac{\overset{2}{\cancel{12}}n}{\underset{1}{\cancel{6}}} = \frac{5}{\underset{1}{\cancel{2}}} \cdot \overset{6}{\cancel{12}}$$

$$2n = 30$$

$n = 15$. *Ans.*

Proof: $\frac{\overset{5}{\cancel{15}}}{\underset{2}{\cancel{6}}} = \frac{5}{2}$

$$\frac{5}{2} = \frac{5}{2}$$

Find the value of the number represented by the letter in each of the following equations, and prove your answer:

1. $\frac{10}{3} = \frac{n}{6}$
2. $\frac{3}{10} = \frac{x}{20}$
3. $\frac{5}{6} = \frac{n}{12}$
4. $\frac{4}{3} = \frac{n}{6}$
5. $\frac{3}{14} = \frac{n}{7}$
6. $\frac{15}{n} = 3$ (Multiply by n)
7. $\frac{128}{n} = 4$
8. $7 = \frac{112}{n}$

Ratio and Proportion

The relation between two numbers found by dividing one by the other is called the ratio between the numbers. Thus the ratio between 6 and 8 found by division is $6 \div 8$ or $\frac{3}{4}$; that is, the ratio between 6 and 8 is $\frac{3}{4}$. The ratio between 6 and 8 may be written in either of two ways: 3 : 4 (read 3 divided by 4), or $\frac{3}{4}$.

The statement of the equality of two ratios is a proportion.[1] Thus, the ratios $\frac{5}{6}$ and $\frac{10}{12}$ are equal and the statement $\frac{5}{6} = \frac{10}{12}$ (or as it is commonly written 5 : 6 :: 10 : 12) is a proportion. The fractional form is more convenient for computation.

There are four terms in a proportion. The first and third terms are the numerators of the fractions; the second and fourth terms are the denominators. The first and last terms (5 and 12) are called the extremes; the second and third (6 and 10) are called the means.

In a proportion the product of the means is equal to the product of the extremes.

Exercise III

Problem.—Find the value of the term represented by a letter in the proportion

$$\frac{8}{10} = \frac{12}{x}$$

Multiplying both members of the equation by $10x$,

$$8x = 120$$

Dividing both members of the equation by 8,

$$x = 15.$$

Proof:

$$\frac{8}{10} = \frac{12}{15}$$

$$\frac{4}{5} = \frac{4}{5}$$

[1] The fractional form of the proportion is used throughout the text. The other is given because of its importance in the history of mathematics.

Find the value of the term represented by a letter in each of the following proportions:

1. $\frac{5}{6} = \frac{10}{x}$
2. $\frac{8}{9} = \frac{40}{x}$
3. $\frac{18}{27} = \frac{14}{x}$
4. $\frac{16}{10} = \frac{8}{x}$
5. $7 : 9 :: 21 : x$
6. $\frac{4}{11} = \frac{5}{x}$
7. $\frac{3.5}{7} = \frac{.013}{x}$
8. $\frac{3}{48.3} = \frac{7.1}{x}$

EXERCISE IV

Problem.—If 8 yards of silk cost \$12, how much will 13 yards cost at the same rate?

$$\frac{8 \text{ yards}}{13 \text{ yards}} = \frac{12 \text{ dollars}}{x \text{ dollars}}$$

That is $\frac{8}{13} = \frac{12}{x}$

$8x = 156$

$x = \$19.50.$

That is, 13 yards of silk cost \$19.50.

Rules for Forming a Proportion

(*a*) The two terms of each ratio must be like quantities, *e.g.*, in the illustrative problem, each term of the first ratio is a number of yards, of the second, a number of dollars.

(*b*) The two numerators and the two denominators must be corresponding quantities; that is, the value of one numerator must depend upon the value of the other numerator. For example, in the illustrative problem, the value of the second numerator, \$12, depends upon the number of yards purchased, or 8 yards, and the value of the second denominator, x dollars, depends upon the number of yards purchased, or 13 yards.

Solve the Following Problems by Proportion

1. If 5 yards of velvet cost \$24.25, find the cost of 3 yards.
2. If 3 lbs. of dried beef cost \$1.35, how many pounds can be bought for \$1?
3. A man at moderately active work, who weighs 154 pounds, requires 3400 Calories (heat units) of food per day. At this

rate, how many Calories would be required by a man who weighs 185 pounds?

4. If eggs cost 45 cents a dozen, find the cost of eggs for a family which uses 5 for breakfast?

5. New potatoes cost 45 cents per 4 quarts. At this rate, find the cost per peck.

6. After the cream has been removed from a quart of whole milk, .9 of a quart of skimmed-milk is left. If this amount of skimmed-milk is worth $.064, what is it worth per quart?

7. On an annual income of $1800, $350 is set aside for rent. At the same rate, how much should be set aside from an income of $2100?

8. In a drawing, the lines representing the length and width of a room are 1¼" and 1" respectively. If the room is 38 feet long, how wide is it?

9. Four girls went to different stores and bought 5 cents worth of 40-cent butter, weighed the amounts on the scales at school and found that they had been given 1½ oz., 1¼ oz., 1⅞ oz., and 2¼ oz., respectively. In each case, find the cost of a pound at the same rate. Why should the grocer charge a higher rate for small quantities?

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